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Intel Pentium III Processor, 650 MHz	Intel Pentium III Processor, 600E MHz	Intel Pentium III Processor, 500 MHz	Intel Pentium III Processor, 500 MHz
128 MB 100 MHz SyncDRAM expandable to 384 MB	128 MB 100 MHz SyncDRAM expandable to 384 MB	64 MB SyncDRAM expandable to 384 MB	128 MB SyncDRAM expandable to 384 MB
20.0 GB (7200 rpm) UltraDMA Hard Drive[1]	13.4 GB (7200 rpm) UltraDMA Hard Drive[1]	13.0 GB UltraDMA Hard Drive[1]	13.0 GB UltraDMA Hard Drive[1]
10X DVD-ROM Drive[7]	10X DVD-ROM Drive[7]	32X Max CD-ROM Drive[7]	32X Max CD-ROM Drive[7]
3Dfx Voodoo 3 3500 Graphics Card with 16 MB	Voodoo 3 1000 2X AGP Graphics Card with 16 MB	Voodoo 3 1000 2X AGP Graphics Card with 16 MB	Voodoo 3 1000 2X AGP Graphics Card with 16 MB
Sound Blaster Live! Value PCI Audio	**Sound Blaster Live! Value PCI Audio**	**Sound Blaster Live! Value PCI Audio**	ESS Solo PCI Audio
6.0Mb Max Digital Modem[5]	56K ITU V.90 Modem[3]	56K ITU V.90 Modem[3]	56K ITU V.90 Modem[3]
JBL Pro Premium Speakers w/Subwoofer	**Klipsch v.2-400 Watt Speaker System**	**Klipsch v.2-400 Watt Speaker System**	JBL Pro Amplified Speakers
Digital Creativity Imaging Center[8]	Digital Creativity Imaging Center[8]	Digital Creativity Imaging Center[8]	Digital Creativity Imaging Center[8]
6.0 Mbps Home Phoneline Networking Card[11]	Microsoft Featured Home Collection	Microsoft Featured Home Collection	Microsoft Featured Home Collection
Microsoft Featured Home Collection + MS® Word	Microsoft Word	Microsoft Word	Microsoft Word
Microsoft Windows98	Microsoft Windows98	Microsoft Windows98	Microsoft Windows98
Compaq CV715 17" Monitor (16.0" VIA)	Compaq CV715 17" Monitor (16.0" VIA)	Compaq CV515 15" Monitor (13.8" VIA)	Compaq CV515 15" Monitor (13.8" VIA)
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Compaq CV915 19" Monitor (18.0" VIA): Add $200	Compaq CV915 19" Monitor (18.0" VIA): Add $200	Compaq CV715 17" Monitor (16.0" VIA): Add $70	Compaq CV715 17" Monitor (16.0" VIA): Add $70
Agfa Snap Scan USB Scanner: Add $129	**HOLIDAY PROMOTION:** 4X CD-RW Drive[10]: Add $1[6]	**HOLIDAY PROMOTION:** 4X CD-RW Drive[10]: Add $1[6]	Intel PC Camera Pack USB: Add $79

PRESARIO 1800T-500 INTERNET NOTEBOOK PC	PRESARIO 1900T-400 INTERNET NOTEBOOK PC	PRESARIO 1800T-450 INTERNET NOTEBOOK PC	PRESARIO 1800T-433 INTERNET NOTEBOOK PC
Intel Mobile Pentium III Processor, 500 MHz	Intel Mobile Pentium II Processor, 400 MHz	Intel Mobile Pentium III Processor, 450 MHz	Mobile Intel Celeron™ Processor, 433 MHz
14.1" TFT Active Matrix Display	13.3" TFT Active Matrix Display	14.1" TFT Active Matrix Display	15.0" TFT Active Matrix Display
64 MB SyncDRAM expandable to 192 MB	64 MB SyncDRAM	64 MB SyncDRAM expandable to 192 MB	64 MB SyncDRAM expandable to 192 MB
10.0 GB UltraDMA Hard Drive[1]	6.0 GB UltraDMA Hard Drive[1]	6.0 GB UltraDMA Hard Drive[1]	4.8 GB UltraDMA Hard Drive[1]
6X DVD-ROM Drive[4]	**6X DVD-ROM Drive[4]**	24X Max CD-ROM Drive[9]	24X Max CD-ROM Drive[9]
ATI Rage LT Pro Hardware Accelerated 3D Graphics with 8 MB Video Memory	ATI Mobility Hardware Accelerated 3D Graphics with 8 MB Video Memory	ATI Rage LT Pro Hardware Accelerated 3D Graphics with 8 MB Video Memory	ATI Rage LT Pro Hardware Accelerated 3D Graphics with 8 MB Video Memory
56K ITU V.90 Modem (PCI)[3]	56K ITU V.90 Modem (PCI)[3]	56K ITU V.90 Modem (PCI)[3]	56K ITU V.90 Modem (PCI)[3]
Ultra Hi-Capacity Lilon Battery	Ultra Hi-Capacity Lilon Battery	Ultra Hi-Capacity Lilon Battery	Ultra Hi-Capacity Lilon Battery
256 KB Integrated "On-chip" cache	256 KB Integrated "On-chip" cache	256 KB Integrated "On-chip" cache	128 KB Integrated "On-chip" cache
10/100 Base T Ethernet Network Card	Microsoft Featured Home Collection	10/100 Base T Ethernet Network Card	10/100 Base T Ethernet Network Card
Microsoft Featured Home Collection	Microsoft Windows98	Microsoft Featured Home Collection	Microsoft Featured Home Collection
Microsoft Windows98		Microsoft Windows98	Microsoft Windows98
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18.0 GB UltraDMA Hard Drive[1]: Add $300	QuikDock with Integrated Ethernet: Add $129	96 MB SyncDRAM: Add $100	6.0 GB UltraDMA Hard Drive[1]: Add $100
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CONTENTS: Answers to Y2K's most pressing questions. Which CPU should you buy? What's the smartest videocard upgrade? Should you ditch Windows for Linux? And many, many more...

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- Creativity Action Center
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- ATI Mobility Hardware Accelerated 3D Graphics with 8 MB Video Memory
- 56K ITU V.90 Modem (PCI)[3]
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2) MPEG-2 capture requires ALL-IN-WONDER 128 and Pentium III system.

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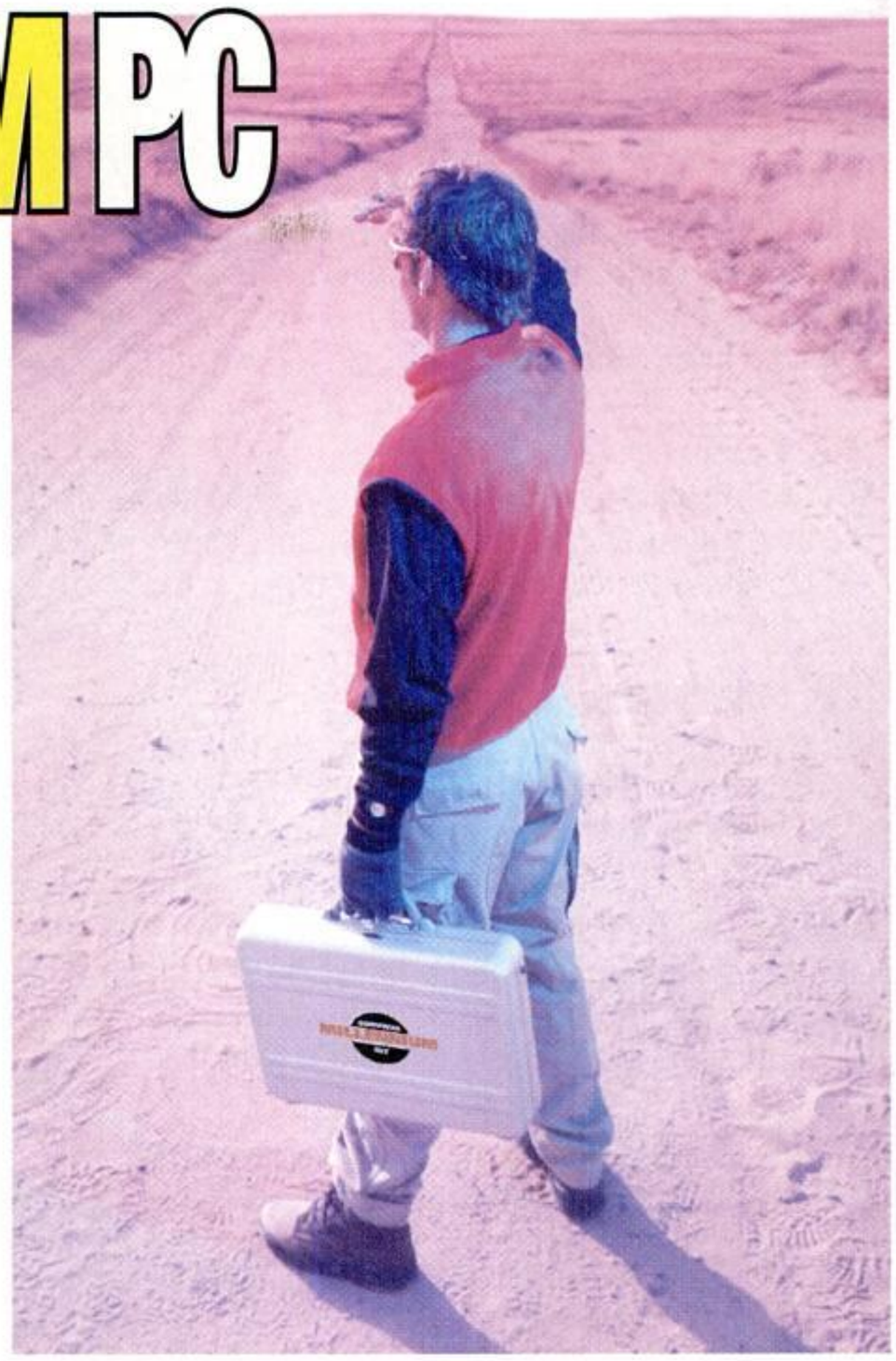
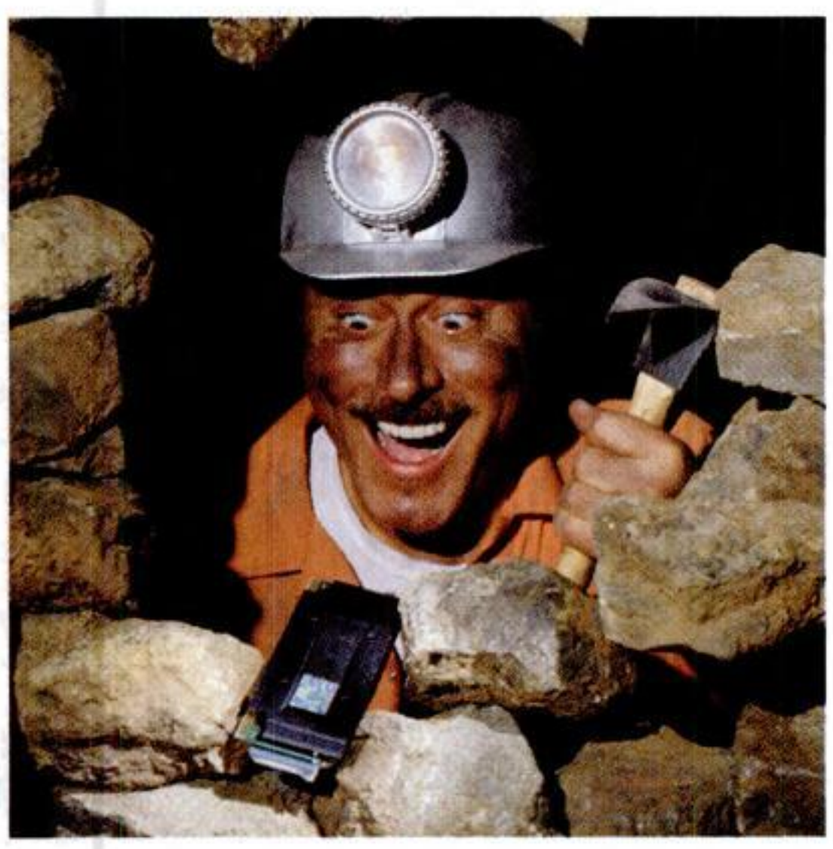


44 Millennium Survival Guide

You survived Y2K, but are you ready to trek through the new millennium's treacherous PC landscape? Fear not, weary road warrior, because inside we preview all the new technologies that threaten to pose upgrading dilemmas in 2000. Included are full reports on everything from CPUs, to videocards, to Windows, and 19 survival plans to help you escape the PC tundra.



58 Coppermine

Woo-hoo! We struck a vein of copper! Now we just have to figure out how to excavate these things without ruining their delicate interconnects. Intel's new Coppermine Pentium IIIs are built for speed and efficiency. But how do they compare to earlier Pentium IIIs, and to AMD's Athlon? We run a slew of comparative tests, and review two hot new Coppermine-based systems from Dell and Micron.

72 Dreamweaver 2

Meet Geoff Visgilio. Geoff's our new associate editor. He's also a part-time stalker, and he's taken a keen "interest" in the rest of staff. Luckily for us, Geoff himself documented his activity on a web page. Follow along as "The New Guy" shows you how to make your own stalking site with *Dreamweaver 2*.

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41 Game Theory
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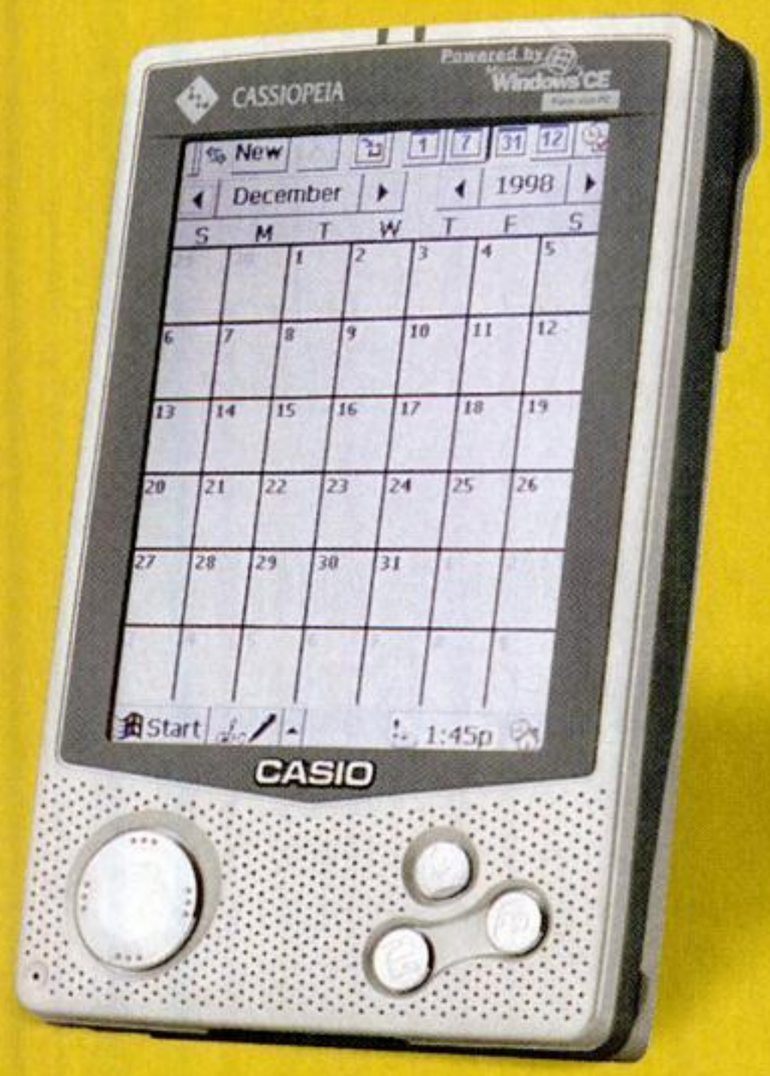
112 Glitch
This month's *Minimum PC* includes reviews of what we *believe* to be computer parts. We're really not sure, because, you know, we're still getting used to the whole "PC" thing.

MINIMUM PC

Maximum BS, p.112



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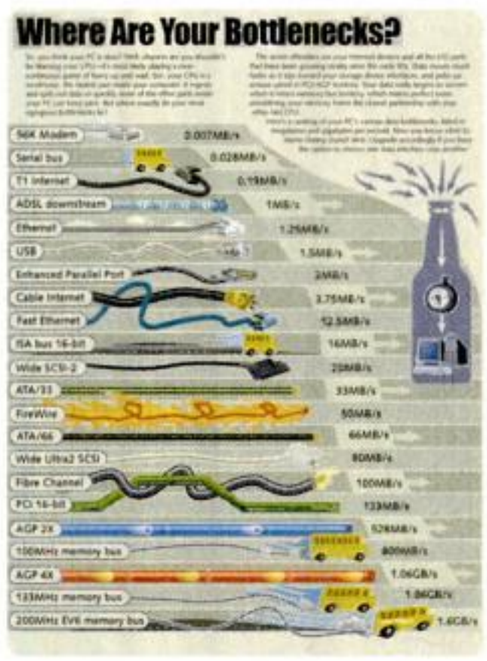
▶ NEWS

20 Inside Sources

PC Previews, News, and Factoids

▶ Say hello to Windows 2000, the natural successor to... Windows NT? That's right, Mr. Peepers, this ain't no "consumer" OS. Or is it? Win00 includes DirectX for gaming junkies. We like, we like! Also: Get to know your bottlenecks.



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75 Ask the Doctor
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110 Terminator
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▶ PRODUCTS

32 Peripheral Vision
High-tech toys on the PC periphery. This month we look at a 200X microscope that displays images on your PC monitor; a fully decked GPS system that can help you find any computer store in the U.S.; and a handheld scanner for super-secret espionage jobs.

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79 Reviews
Do you speed? You will this month with help from three fast **CD recorders**, and three even faster **SCSI hard drives**. We also bring the noise with a trio of **speakers**, including the **Klipsch Pro Media** five-piece powerhouse. Gaming galore comes courtesy of **Rogue Spear**, **Age of Empires II**, and **Madden 2000**. And all you "creative types" can check out three pieces of **music software** and **Painter 6**.

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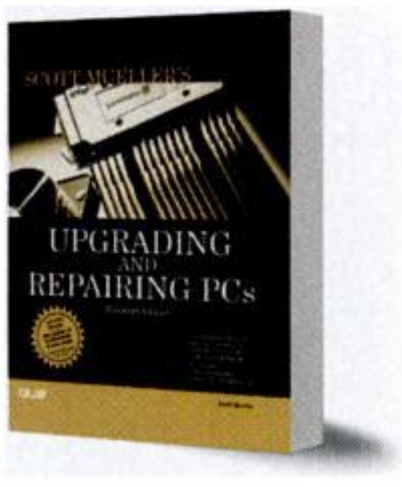

HOW THE INTERNET WORKS, MILLENNIUM EDITION

by Preston Gralla

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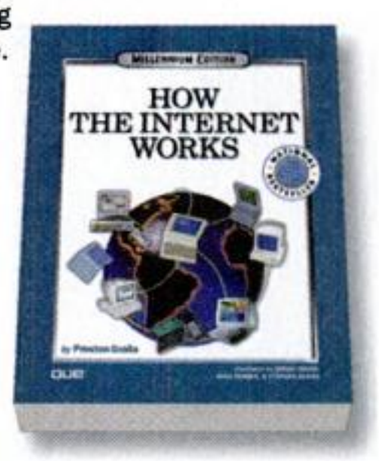

HOW TO DO EVERYTHING WITH YOUR iMAC

by Todd Stauffer

The perfect user manual for the iMac contains all you need to know about your new machine, from making it PC-compatible to getting on the Internet, from troubleshooting to keeping it virus-free.
(Osborne)

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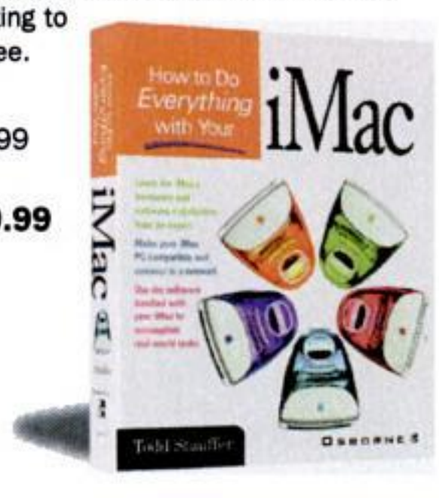

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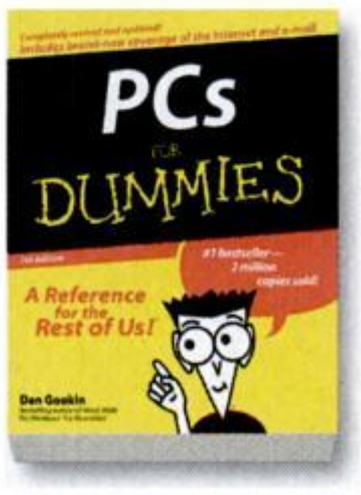

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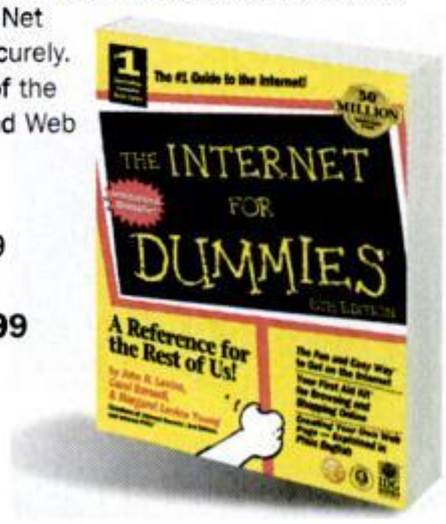

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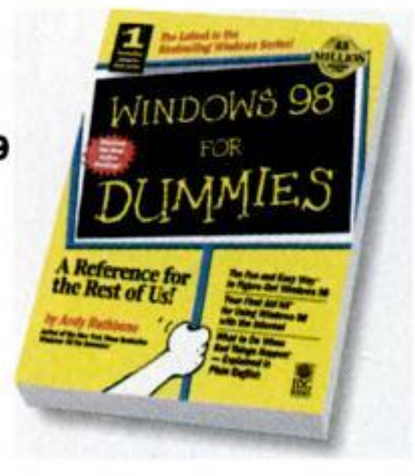

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EDWORD

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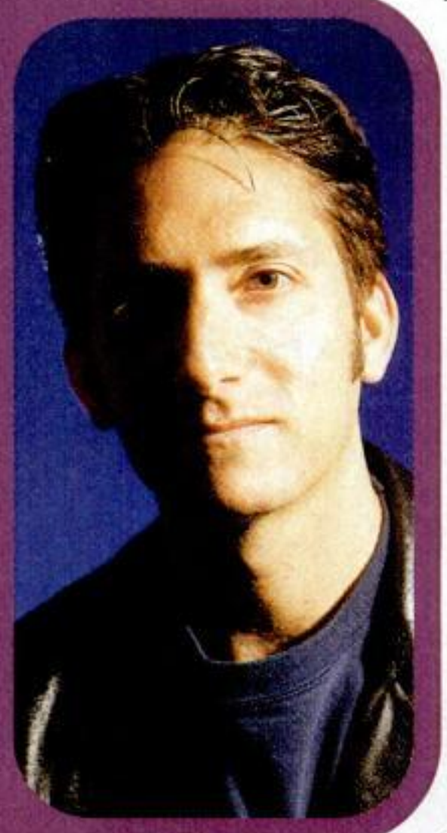

We issue a challenge to all system manufacturers: Build the perfect 10. Become the first PC vendor to break the shackles of the dreaded 9 verdict. That's right—our editorial staff has never awarded a perfect 10 to *any* desktop PC. Not once since the birth of *Maximum PC*, and not once during the run of *boot* magazine, *Maximum PC*'s primordial earth mother.

Some readers might argue that no assembly-line system could ever deserve a perfect score, but these are folks who like to build their own PCs for the pure pleasure of tinkering. There is perhaps no more noble cause, but constant jumper jimmying does lead to system instability and machines that are in constant states of disassembly.

Other readers actually want the reliability of a pre-fab system and its accompanying warranty—and these folks shouldn't be denied Pure PC Power. This editorial is for those fanatics, and the OEMs that serve them.

So, what describes the perfect desktop config? Dig:

▶ It starts with the highest-performing core components, across the board. For CPUs, this means either Intel's or AMD's fastest silicon, running on the speediest memory bus the processor supports—and if this demands using a third-party core-logic chipset, so be it. Videocard? At this point in time, we're talking a GeForce 256 accelerator. Hard drive? It must hold at least 20 gigs, spin at 7200rpm, and ride the ATA/66 interface.

▶ The system's benchmarks must fulfill the promise of the core components. Current Lab records must at least be equaled, if not obliterated.

Current Lab records must at least be equaled, if not obliterated.

▶ The mobo must feature soft jumpers, and come with a manual that explains every BIOS setting in detail.

▶ The case must reinvent the concept of "easy access." We request an entirely screwless design with fold-out partitions that grant immediate entrée to anything we'll ever need to remove. And tidy wiring is a must.

▶ Speaking of access, we want open drive bays, memory slots, and PCI slots—and if that entails including a six PCI-slot motherboard, well, then bring it on. We'll also need a 300W power supply to accommodate all upgrades, plenty of fans to keep them cool, and a front-mounted thermometer to keep us abreast of looming meltdowns.

▶ As "power parts" become cheaper and cheaper, "feature parts" are more important than ever. The perfect 10 includes a CD-RW; Zip drive; DVD-ROM drive; hardware MPEG-2 decoder; top-of-the-line soundcard with dual-outs; and Dolby Digital 5.1 speakers (we'd accept the Klipsch ProMedias, which aren't 5.1-capable but received a 10 in this issue). And let's not forget Ethernet support for home networking and DSL, and a USB mouse and keyboard.

▶ Our monitor must be a large aperture grille display; the flatter the better. Extra credit goes to any OEM that can bundle a digital flat-panel for dual-display action.

▶ Speaking of dualism, we want both Windows 98 *and* Linux on this box.

▶ Finally, we want a wizard that launches the first time we boot the machine, and helps us remove all pre-installed system tray apps and schedulers that suck precious system resources.

The config I describe might actually warrant a 12 or 13 verdict. But if a manufacturer could satisfy even the sweet spot of these criteria, its machine would certainly deserve a perfect 10. Now, who has the guts to sell this machine to the public? The gauntlet has been tossed.

Jon Phillips, editor-in-chief

MAXIMUM PC

jan00 vol5issue1

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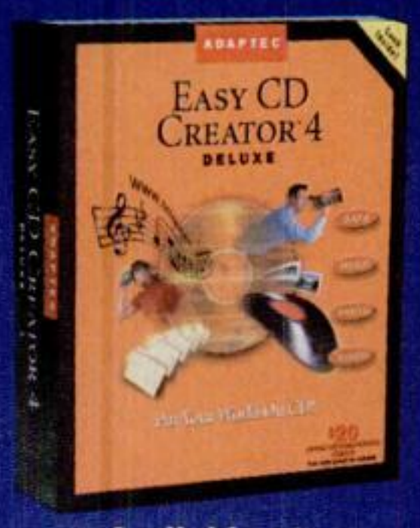

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LETTERS

DSL is (Apparently) Everywhere

Our November issue had been on newsstands for just 24 hours when we were hit with K upon K of e-mail addressing the high-speed net access cover story. The strongest message you sent to us was that DSL service is everywhere—Alaska, Alabama, Arizona, and all the other states we reported as being DSL-deprived.

We apologize for the bogus information. It was supplied by the people at Getspeed.com; like everyone else in the DSL scene, they're having a hard time keeping track of nationwide DSL rollouts. But perhaps we should all view our miscue as a positive one: It proves that DSL is blanketing North America at such a fast pace, even a site devoted to high-speed net access can't keep up. Hopefully, DSL will arrive in your remote burg sometime soon.

We also heard from numerous DirecPC satellite users complaining about their draconian access plans. Hughes, the outfit that runs DirecPC, had two weeks to respond to the representative letters below, but could not do so in time. Hmmm.

And, finally, Reader of the Month is... Scott Tarr, a.k.a "Constantine"! Scott has been sending us insightful letters-to-the-editor for years—a few have actually been published—and has always been an intelligent, authoritative voice on the *Maximum PC* online forums. But what makes Scott extra special is that he made the jump from reader to contributor this month. His report on the future of hard drives can be found in the Millennium Survival Kit. Only one other reader has ever been published in *Maximum PC*: Matthew Jolley, who wrote last month's *Drakan* review.

It all goes to prove that "regular guys" can offer as much PC insight as "seasoned editors." That's why we like your letters: They keep us honest and informed.

Sad Satellite Service

Many of your articles have really bailed me out. This time, however, your November broadband article gave me a bum steer. Hughes DirecPC is pathetic. Anyone considering this turkey should pay a visit to the alt.satellite.direcpc newsgroup, where you'll change your mind in a hurry. Real-world speeds fluctuate wildly, and timeout errors halfway through large downloads are more the rule than the exception.

Also, DirecPC's "Fair Access Policy" guarantees that your download speeds will be throttled down if you establish a pattern of heavy downloading. But aren't their ads designed to attract power users? Finally, their "push" newsgroups intentionally omit the MP3 and warez binaries in order to save bandwidth, so there's very little joy there.

Think people hate the phone company? Wait until you get an earful from the average DirecPC subscriber. Maybe I can still sell this POS on eBay.

—Robert Floyd

Although Hughes doesn't reveal FAP implementation specifics, users report effective download speeds being reduced to sub-dialup data rates.

Hughes restricts usage through its "Fair Access Policy" (FAP), essentially choking off high-volume users by throttling back their data rate as more and more data is downloaded. Although Hughes doesn't reveal FAP implementation specifics, users report effective download speeds being reduced to sub-dialup data rates.

Hughes does state that FAP throttling will *not* occur for "Web surfers and those performing occasional software downloads..." However, "Heavy users of Newsgroups and FTP downloading, on the other hand, may experience FAP." Which group do you think is reading *Maximum PC*?

—Tony Asch

Who You Calling 'Sell-Out'?

Is there any mag that hasn't been bought by Intel? For crying out loud, the AMD chip is far superior to the P-III, yet even your mag sided with Intel. All of your tests prove without a doubt that the Athlon chip should be the one consumers purchase with any new PC.

What really got me was that your only points of contention with AMD were performance differences between SSE and 3DNow! Really, how many pieces of software are configured to take full advantage of SSE? So, this point of testing is virtually moot.

It would be nice to see a mag that finally gives AMD what it deserves.

—Tom Murray

Editor-in-chief Jon Phillips responds: First, I find solace in the fact that an equal number of readers accuse us of being either Intel or AMD pawns. I interpret this as anecdotal evidence that our CPU coverage is fair. As for Mr. Murray's payola accusation, I have to wonder how he interprets our decision to award CPU of the Year to the Athlon. Regardless, while we truly believe the Athlon is a better overall processor, we have to give the Pentium III its props: It absolutely screams when running SSE-optimized applications.

At this point in time, both Intel's SSE and AMD's 3DNow! instructions can speed up floating-point

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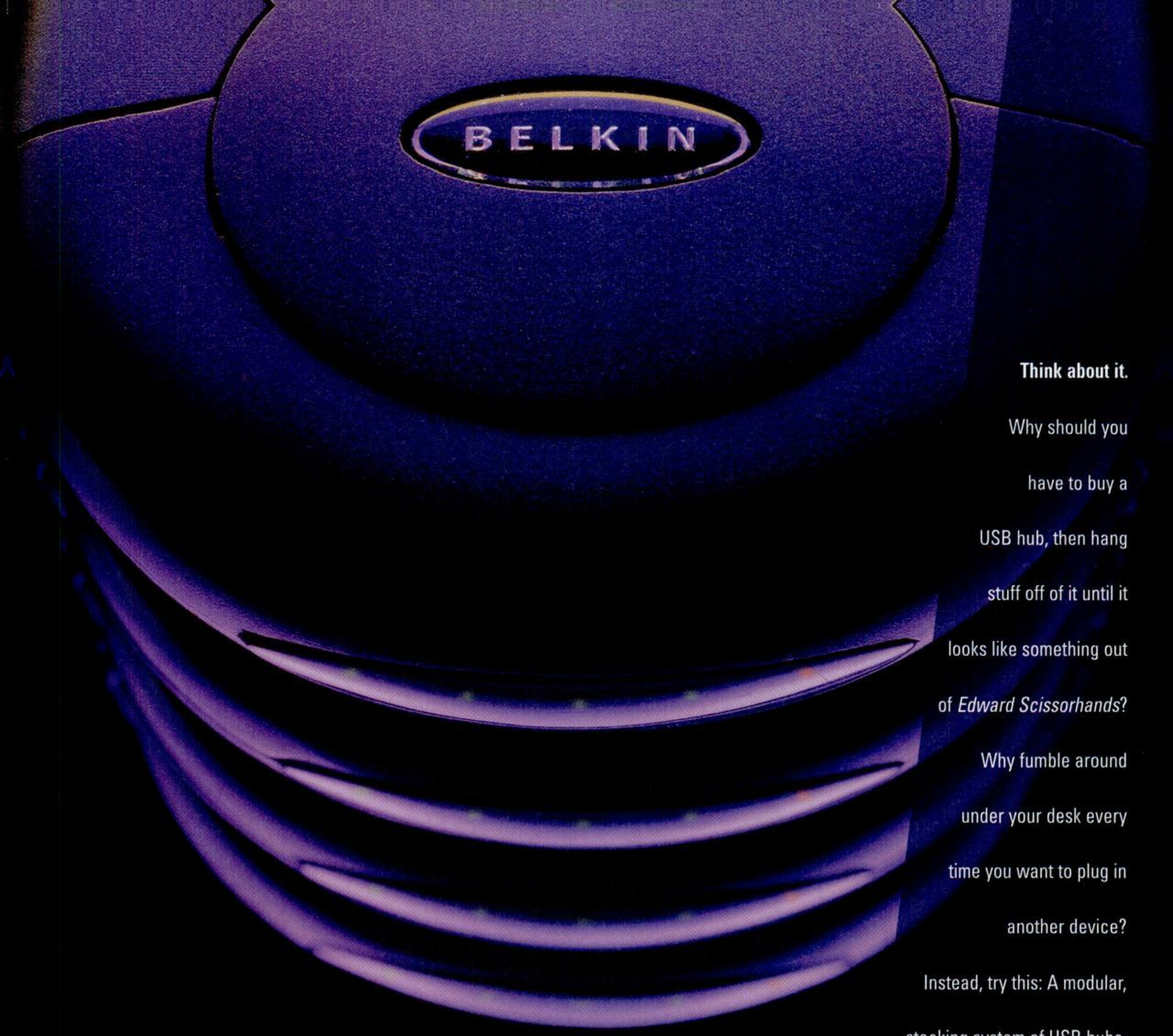

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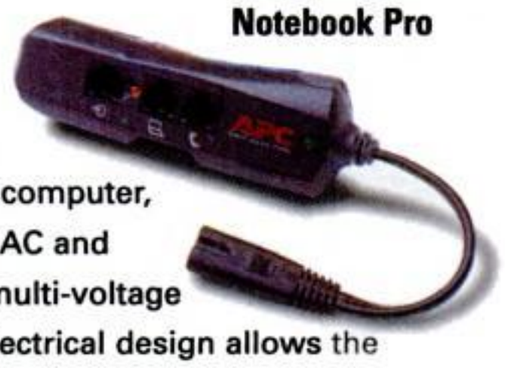

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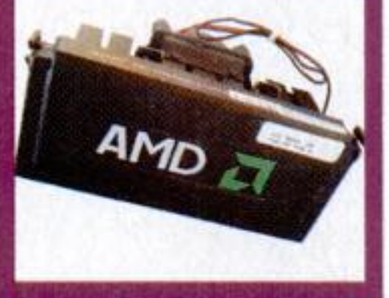
operations in games and applications. However, it would appear that there are more prime-time applications coded to SSE than there are prime-time applications coded to 3DNow!—*Photoshop* is a prime example. And if your favorite application can receive a kick-start from SSE, then buying a Pentium III for that express purpose becomes an attractive proposition.

We will concede that Intel has not done an adequate job evangelizing all the games and apps that feature direct hooks into SSE. Its web site does not frequently update new additions to the SSE family.



For crying lout loud, the AMD chip is far superior to the P-III, yet even your mag sided with Intel.

In the long-run, we think SSE and 3DNow! adoption will mirror MMX adoption: When MMX launched, software developers trumpeted the fact that their games were MMX-optimized. Then the MMX allure petered out, and now, three years later, you can't find an MMX sticker on a software box. But make no mistake, much of today's software includes MMX calls that you don't even know about. Toggle off those MMX instructions and your performance will crawl. Expect the same situation to evolve with SSE and 3DNow!—they'll become implicit members of the x86 family.

Still a TV Blunder?

I've been wanting to get a TV tuner card, and I'm curious about the ATI TV Wonder. According to your October review, it gave excellent quality TV, but was plagued by horrendous drivers. I took a peek at the ATI web site, and it looks like the newest drivers are ready. Do the new drivers fix the problem?

—*Paul Ferrell*

Departments editor Sean Downey responds: ATI did fix some of their bugs with version 2.0 of their desktop multimedia suite. But they've also introduced new bugs in the new drivers. There are lots of cool features (including a sleek video editor) to play with this time round, and the TV Wonder's video capture actually works as advertised now, but the new software is none too stable.

The ATI TV Player crashed our system repeatedly, and its VCR capabilities are still limited. But when the TV Player did work, its functionality was commensurate with All-in-Wonder quality. Video-capture quality was excellent at 320x240, but didn't work at 640x480. And it still doesn't do MPEG-2. We regretfully advise that you stay away from the TV Wonder, because we found that it still isn't 100% healthy.

Challenge Mr. Halfhill at Your Own Risk

I absolutely detest when a computer journalist tries to write an article on anything having to do with videogames ("Console Comeback," Tom Halfhill's November Fast Forward column). To write a videogame article, you have to be a player yourself. That's why computer journalists get blind-sided by companies such as Sony—they don't know any better. They've never actually immersed themselves in the videogame world, a world that is radically different from computers, despite what many computer writers tend to think.

Foremost, I'd like to state that Toshiba never helped design the PlayStation 2's chip; it is merely helping Sony manufacture it. Ken Kutargi, the man behind the original PlayStation, and his team are pretty much the sole designers of the PS2.

Next, ArtX is helping Nintendo with its latest system, not Sony. The enormous polygon number you quoted is also wrong. No game uses gourad-shaded polygons anymore, and developers are going to use every special effect available to make their games look better. This in itself whittles the polygon number to 20 million. Throw in bottlenecks, AI, physics, and you've got roughly around 7 to 10 million polys. Not a whole hell of a lot more than the 5 million that the Dreamcast can push.

Also, the weakest chip in the system is indeed the original PSX's chip (it's in there for backwards compatibility, which is a very grave mistake, but

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that's another matter). We all know the PSX doesn't even come close to an SGI workstation.

Overall, I thought your article was pretty decent as far as videogame articles from computer writers goes, but next time, don't get blinded by the hype.

—S. Siberio

Contributing editor Tom Halfhill responds: In the first place, I know more about videogames than you might imagine, having been the launch editor of one of the early videogame magazines in the 1980s. But that doesn't matter, because my column wasn't really about videogames—it was about the microprocessors in a videogame machine, and microprocessors are my specialty. In my day job, I'm an analyst at MicroDesign Resources, the publisher of *Microprocessor Report*.

That doesn't mean I'm flawless, and my column did contain one glaring mistake. As you pointed out, ArtX is designing a graphics chip for Nintendo's next-generation game console, not for the PS2. Actually, I emailed a correction to my editor at *Maximum PC* the day after I submitted my column, but the correction was misplaced due to a management transition at the magazine. *[Yes. It was our goof!—Ed]*

I must disagree with some of your other points. Toshiba's role in designing the Emotion Engine is a matter of debate between the two companies. This came up when Sony and Toshiba were invited to give a technical presentation of the Emotion Engine at the Embedded Processor Forum, an annual event sponsored by MicroDesign Resources. The squabble was never settled to our satisfaction, but Sony did end up giving a presentation that was well-received.

The performance figures I quoted are not "wrong"—the sources are Sony and Toshiba, and the figures are consistent with the system's floating-point capabilities, which are evident in the microarchitecture. Of course, how well those claims translate into real-world performance is yet to be seen. That's always the case with unverified benchmarks. As I said in my column, however, I've seen live demonstrations of PS2 prototypes, and the machine is definitely impressive. There is no question that the Emotion Engine's floating-point performance is superior to that of the Hitachi SH-7750 processor in the Sega Dreamcast. Even Hitachi wouldn't claim otherwise.

My column didn't say the PS2's I/O processor is as powerful as an SGI workstation. I said the PS2 total system is as powerful at 3D graphics as an SGI workstation, and I said the I/O processor is the same type of chip found in an SGI workstation. The I/O processor is clocked at a lower frequency than the CPUs found in SGI workstations, but that's a deliberate tradeoff. Sony could easily run this chip at a much higher frequency in the PS2, but chooses not to because it might jeopardize compatibility with PS software that depends on the CPU's precise timing.

Sexy Sensei

Sherry Monarko: Who is she and why is she so beautiful? I'm reading along in my new *Maximum PC*, and eating every word like fresh sushi and BAMM!—Maximum Megahertz! Very melted. You've got to warn us geeky male readers about these things. I think I lost a few days to slathering oblivion after seeing Sherry's pic. How about a full cover in the future? And can you send me a file so I can change my Wallpaper?

—worshipper, Michael Mallyn

Sherry Monarko: Who is she and why is she so beautiful?

Contributing editor Sherry Monarko responds: I'm so beautiful because I take a bath in nori every night. Plus, the emissions from my monitor give my complexion that "healthy glow," and I dye my hair with only browser-safe colors. That way, it looks great no matter what mag you see it in.

I don't think there are plans for a full cover of me. However, if you send me just $50, you'll go on the waiting list for the "Sherry Wall Calendar," in which I have a different hair color for every month!

486 Fanatics Cry Foul On DOS

I won't even wonder why you, the cutting-edge *Maximum PC*, are bothering with trying to make a 486 into a web-browsing superstar. A small network server, yeah, but a surfing machine? And the real question is: DOS?!

How many of us still have a copy of Windows 3.1 sitting around? I do. And stored in the same shoebox in the computer room closet, a copy of *Navigator 2* or *3*? Yup, guilty again. Now, this *Arachne* may be a wonderful thing, but *Navigator 3* on a Win3.1 setup—even given the constraints of a 486—will run rings around anything a DOS-based browser can do. And 3.1, unlike its 95/98 brethren, won't screw up DOS-based gaming, if you're so inclined.

C'mon, if you're going to crank up the 486 again, at least give it a fighting chance.

—Poppa Steve Berggren

With much curiosity, I've renovated a 486-based Gateway 2000. It's a 486/33 DX with 128K cache on a Micronics motherboard. To make a long story short, it is one of the most stable, dependable machines I have ever had. The only parts I added were a 24x CD-ROM drive, an 850MB Samsung hard drive, and a cheap 16-bit sound-card.

Your article dealt with several good points, such as the CMOS battery problem, the small L2 cache (mine was disabled!), and the maze of motherboard jumpers. However, you missed a key point: These machines are perfectly capable of running Windows 98, using a DX66 and above, and preferably 32MB and above of RAM. So, why the *Arachne* jive?

—John McInturff

Editor-in-chief Jon Phillips responds: Poppa Steve and John make some good points. My first PC was a 386 running Win3.1. Of course, it was dog-slow by today's standards—I used to wait 10 to 12 minutes for *CorelDraw!* to complete a simple extrusion effect—but the machine did run a Windows interface. However, the thought of running Windows 98 on a 486 with 32MB of memory sounds positively medieval—"Woohoo! I've got 6% of my memory available!" Or something like that.

The 486 resurrection article received a mixed reaction. Hardcore power-mongers thought it was out of place in *Maximum PC*. Nostalgia buffs said it gave them a nice kick in the pants to reconcile with a long-lost friend. We ran the article because we think most *Maximum PC* readers are system hackers by nature—anyone can go out and buy the fastest processor, but who can get more power from his existing processor, or find new uses for old mothballed parts? *Maximum PC* stands for maximum passion and maximum tinkering as much as it stands for maximum power and performance.

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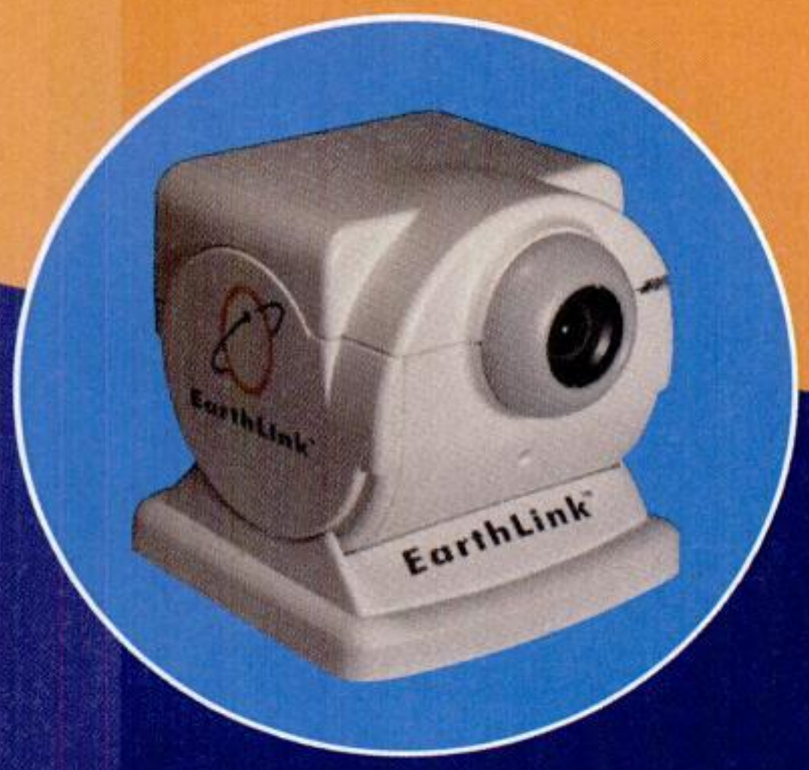

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technology preview ► operating system

Windows 2000

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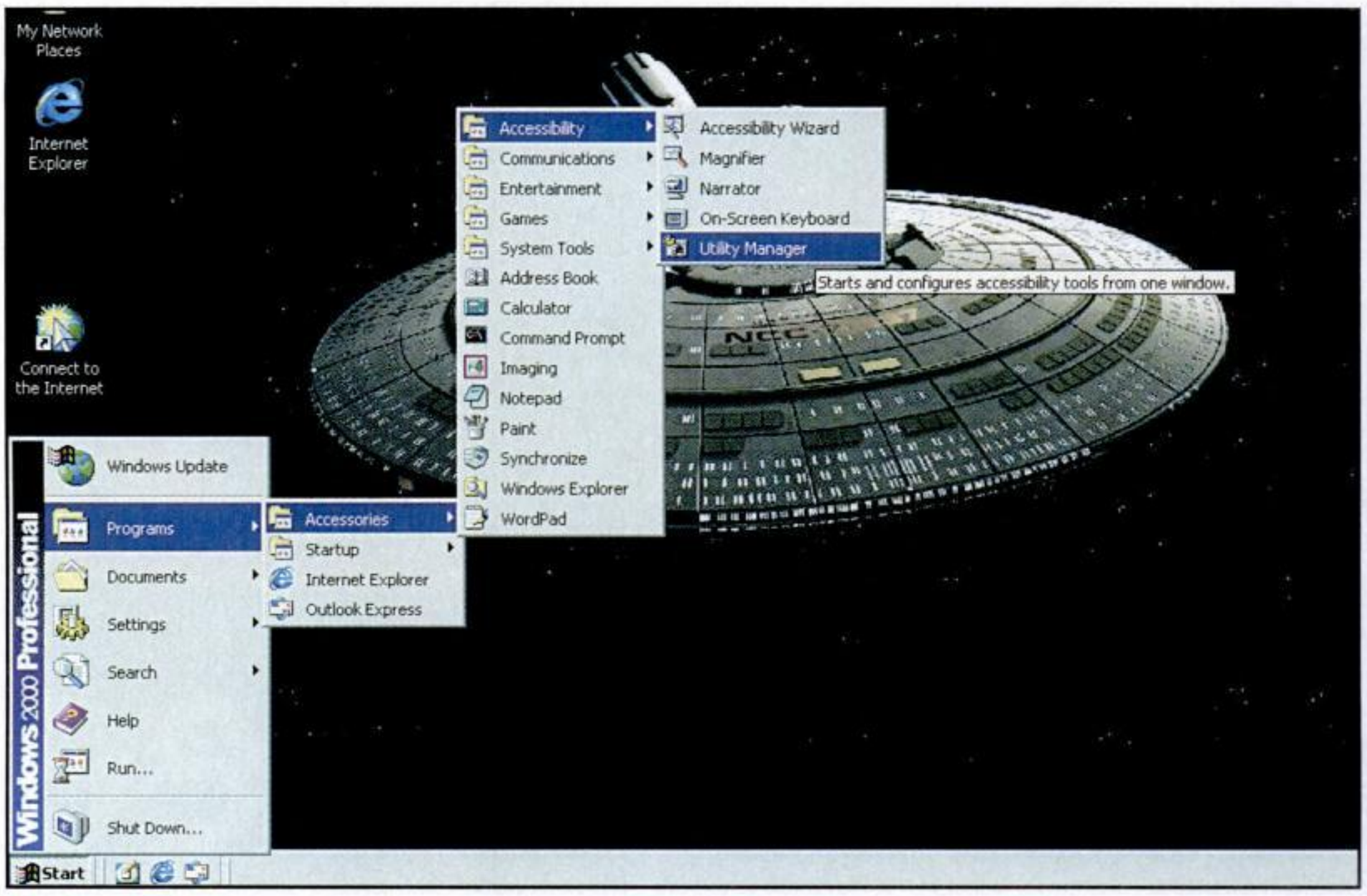
In what may be Microsoft's biggest operating system launch since Windows 95, the company plans to finally release its highly anticipated Windows 2000 this February. But, while Microsoft is promising the arrival of "the easiest Windows ever," not one of the four different versions planned for release is being targeted toward home users. Decidedly *not* an updated Win98, Win00 is actually the natural progression of Microsoft's 32-bit NT operating system. In fact, up until 1998, Microsoft intended to call the new OS NT 5.

The first three versions of Win00—Windows 2000 Professional, for desktops; Windows 2000 Server, for small servers; and Windows 2000 Advanced Server, for mid-range servers—are due out in February. The final version—Windows 2000 Data Center Server, which is slated for use by large corporations—will roll out a few months later.

The version names all sound very stodgy, right? Indeed. Yet somehow these "corporate OSes" will offer full DirectX gaming support, along with all the goodies that have always made power users prefer NT over 95/98. In fact, if you're a gamer who can find a happy home in a world of pure 32-bit applications, Win00 may be the OS for you.



Though there's some 29 million lines of code underneath the hood in Windows 2000, Microsoft didn't make too many changes to the user interface we've come to know and "love."

32-bit Computing For All

To understand where Microsoft is going with Win00 and its operating systems, you have to turn the clock back to the late 1980s when Win3.1 was still king. Microsoft saw that the 16-bit Win3.1 and its DOS foundation didn't have a future, and thus embarked on a long road map to wean consumers off of 16-bit apps.

By 1993, Microsoft released the 32-bit Windows NT 3.51—an optional OS, if you will, targeted at folk who would be happy running a small collection of powerful workstation and server applications. NT introduced network security features, and was targeted at corporations who would buy licenses en masse. Most consumers stuck with Win3.1 to play it safe.

By 1995, Microsoft released Windows 95, which supported both 16-bit and 32-bit applications, and consumers jumped from Win3.1 to this seemingly hospitable OS. Sure, its bloated melange of 16- and 32-bit code was inelegant and buggy, but

SPIN CYCLE

This month's top stories broken down ►

HEADLINE	NEWS	DETAILS	THE SPIN	OUR TAKE
DVD Cracked?	European hackers have found a way to circumvent the encryption that keeps people from copying DVD movies.	The hackers reportedly discovered the crack after a developer at RealNetworks failed to encrypt a key.	Hollywood will pressure technology companies to delay shipping storage devices such as DVD+RW to prevent mass piracy until a fix is found.	No digital media format will ever be piracy-proof. It's time to rethink the concept of intellectual property.
3dfx to Break Speed Barrier	3dfx said its Voodoo^5 6000 will be the first to break the 1 gigapixel per second mark. In fact, it can pump out 1.3Gpixels/sec.	3dfx said it will take four chips and 128MB of memory on a single board to break the barrier.	Ignoring fancy features such as hardware T&L, 3dfx has maintained that fill rate and frame rate will still be king in 2000.	Four chips to compete with a single GeForce 256 or dual-chip ATI Fury Maxx? And exactly how much will this videocard cost?

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for all intents and purposes, the OS "worked." Windows 98 was a mere revision of Win95. On the surface, it didn't offer much more than reliable USB support. Amid Win98's release, power users began salivating for Windows 2000, the first Microsoft consumer OS that would be 32-bit through and through, and offer all the speed and stability of NT.

Fast forward to 1999. Microsoft had hoped that most of the consumer world would finally be ready for a pure 32-bit OS with no 16-bit legacy support. But, unfortunately for Microsoft, home users still weren't ready to embrace the new frontier. There were still too many application compatibility issues to deal with, and many hardware vendors were dragging their heels in developing NT drivers. Thus, with its consumer focus on the Internet, Microsoft shifted its priorities. Windows 2000 was recast as the next NT, a fair designation considering its deep NT roots.

Prosumer Features

Microsoft will only target Win00 at corporate users, who should be drawn to the OS's stability, security, and administration features. You probably won't see Win00 installed on machines sold at CompUSA, but the OS should appeal to certain power users and gamers. For this niche, Windows 2000 Professional offers greater stability than Win98, and blends the best features of NT and Win98. Here's the roll call:

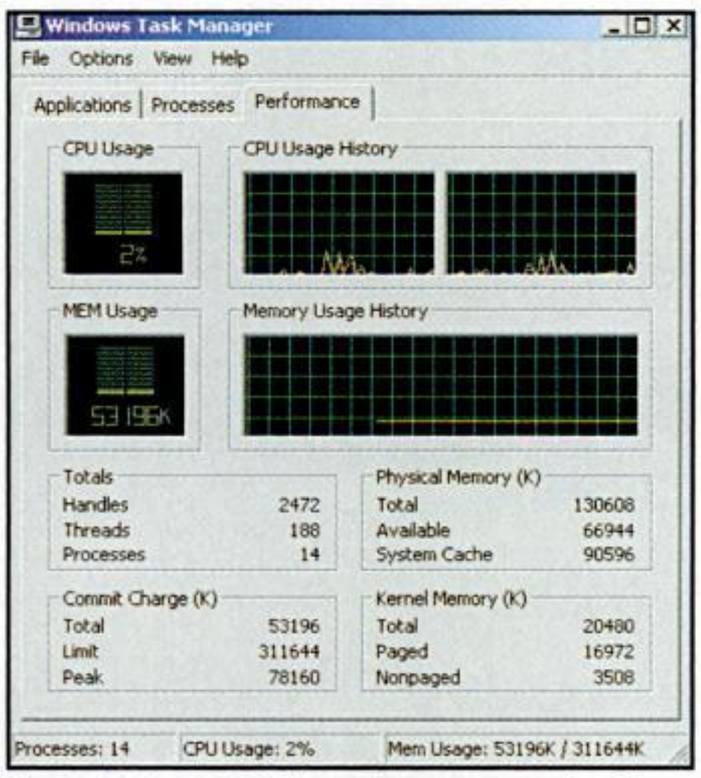
- **Full DirectX support:** Windows NT 4.0 didn't support any DirectX version later than 3.0. Windows 2000 will ship with the latest version of DirectX, and enable a host of accelerated gaming and multimedia applications that NT4 couldn't touch without lengthy sessions of hacking.
- **Plug and Play:** While once derisively referred to as Plug 'N' Pray, PNP has grown to be an invaluable tool when building new machines or adding hardware.
- **USB and FireWire support:** All those newfangled devices, such as USB Zip drives and FireWire DV cameras, should finally work with Win00. While Win98 people have been buying USB mice and scanners for months, NT users haven't had that ability until now.
- **Multiprocessor support:** NT has always supported SMP, but now with DirectX on the griddle, gamers can finally use two processors to supercharge games. *Quake III Arena* supports dual-proc; other titles are sure to follow.
- **Driver Signing and Verification:** Win00 features a tool to locate errors with problematic drivers. Drivers will have encrypted signatures to certify where they came from, as well.
- **Kernel Mode Write Protection:** The OS can write-protect certain memory pages, preventing defective drivers from wiping out critical information and bringing a system down. Once an area is write-protected, even the OS can't touch it.
- **System File Protection:** Win00 will protect system files from being deleted or written over.
- **Better Power Management:** Windows NT 4 was a notorious troublemaker on power-conscious notebooks. Win00 should fix that and also add a hibernate mode that allows an image of RAM to be written to the hard drive. The PC can then be woken up in seconds instead of minutes.
- **Native DVD playback:** Microsoft will finally bundle its own softDVD player with Win00 for playing DVD movies on PCs.

All of these features send an alluring message to those with strong enough machines to run the new OS. Microsoft hasn't set minimum system requirements for Windows 2000 Professional, but most propeller-beanies would recommend at least a 300MHz Pentium II with 128MB of RAM to chug through the 29-million-line OS.

You wouldn't want to load Windows 2000 onto your father's PC, nor would you put the new OS on junior's sub-$1,000 box. However, Win00 could be the OS for you if you're already an NT 4.0 user, or a Win98 user who wants to run dual procs and take gaming to a different level. ✹

Does Anyone Know What NT Stands For?

Commonsense dictates that NT stands for New Technology. Microsoft has never actually defined NT, but one urban legend claims the name comes from the former Digital Electronic Computers executive who helped create it. By adding one letter to each letter of the famed DEC operating system VMS, you get WNT.



You gotta love 2000's performance reports. Dig the dual-proc graphs. Yoo-hoo!

to the pertinent details.

HEADLINE	NEWS	DETAILS	THE SPIN	OUR TAKE
Packard Bell Exits Stage Left	Once an innovator of cheap PCs, Packard Bell will quit making PCs for the U.S. market; many Packard Bell employees have been canned.	Packard Bell lost $650 million in 1998, and never shook the perception that it made downright crappy machines.	NEC, Packard Bell's parent company, described the layoffs as a "realignment" and said remaining Packard Bell employees will sell PCs online under the NEC name.	Only the strong survive and Packard Bell was a weakling from the beginning.
Microsoft A Monopoly	A federal judge has found that Microsoft is a monopoly that impedes consumer choice.	Microsoft and DOJ officials are trying to settle the landmark anti-trust case following Judge Penfield Jackson's monopoly declaration.	"In this industry, no company has a guaranteed position," said Bill Gates. "Microsoft has succeeded because we have been guided by the most basic American values."	While it's difficult to fathom a world without Windows standards, we have to wonder what technologies were smothered by Microsoft to get there.

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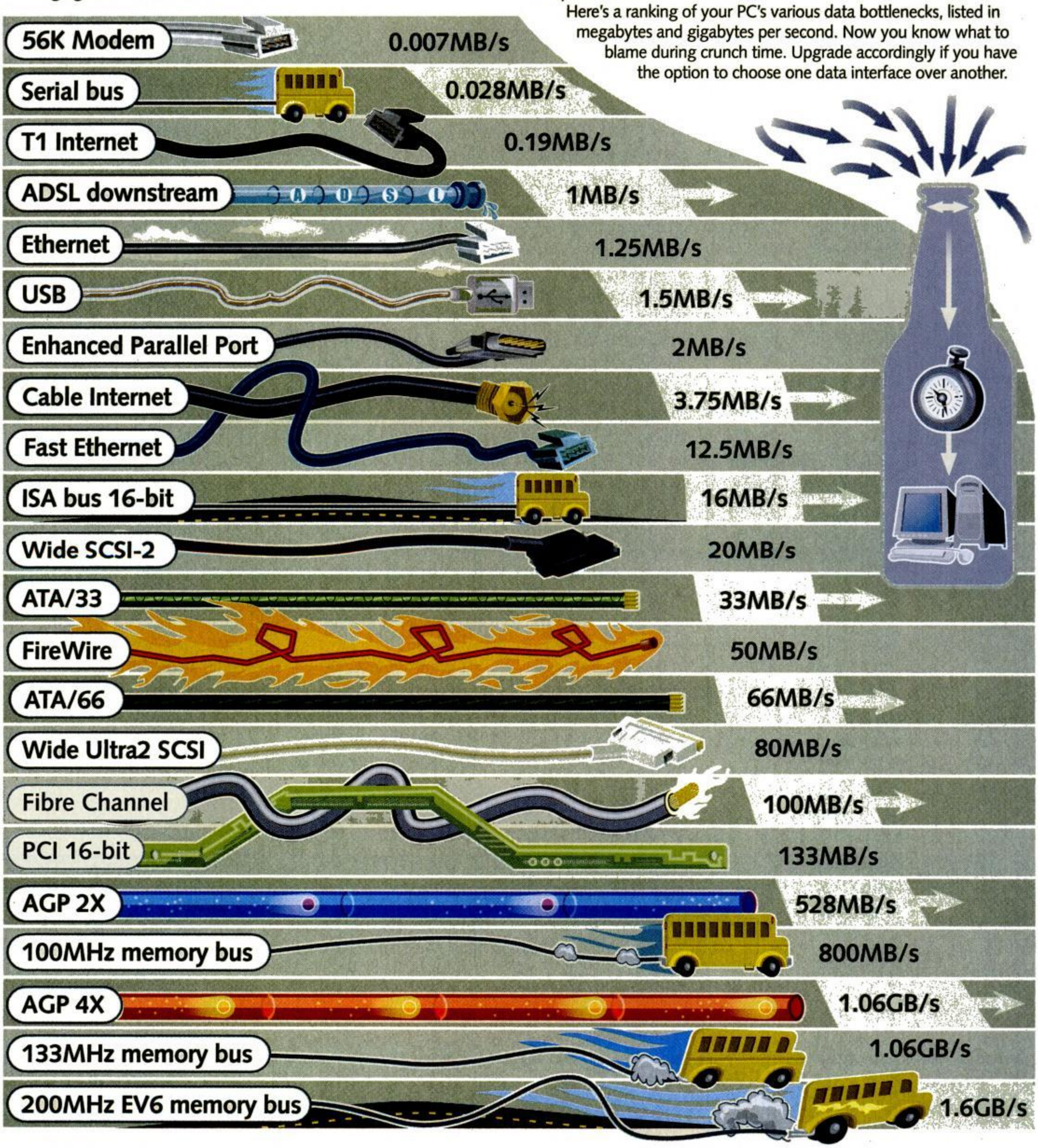
Where Are Your Bottlenecks?

So, you think your PC is slow? Well, chances are you shouldn't be blaming your CPU—it's most likely playing a near-continuous game of hurry up and wait. See, your CPU is a workhorse, the fastest part inside your computer. It ingests and spits out data so quickly, none of the other parts inside your PC can keep pace. But where exactly do your most egregious bottlenecks lie?

The worst offenders are your Internet devices and all the I/O ports that have been growing moldy since the early 90s. Data moves much faster as it zips toward your storage device interfaces, and picks up serious speed in PCI/AGP territory. Your data really begins to scream when it enters memory bus territory, which makes perfect sense, considering your memory forms the closest partnership with your whip-fast CPU.

Here's a ranking of your PC's various data bottlenecks, listed in megabytes and gigabytes per second. Now you know what to blame during crunch time. Upgrade accordingly if you have the option to choose one data interface over another.



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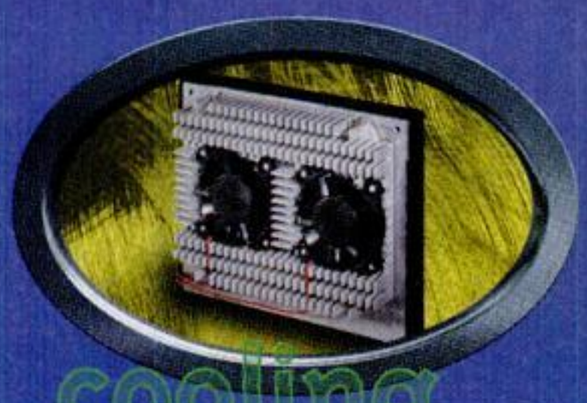

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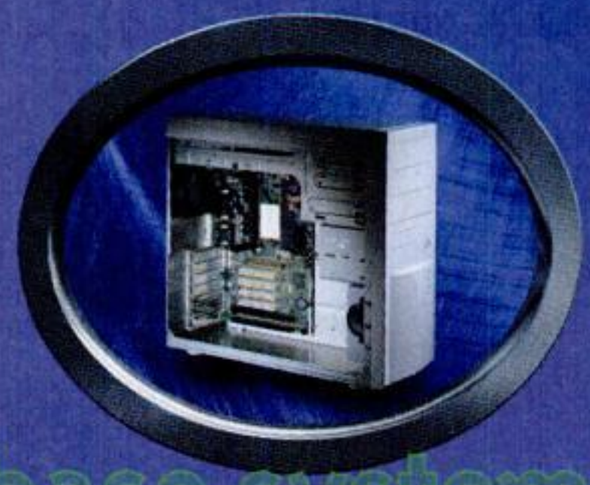

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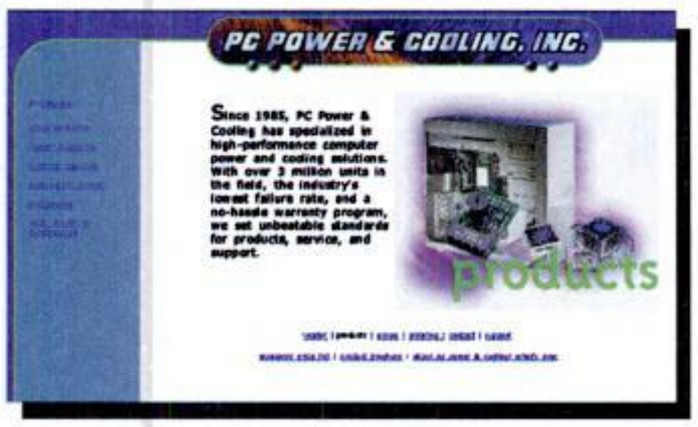

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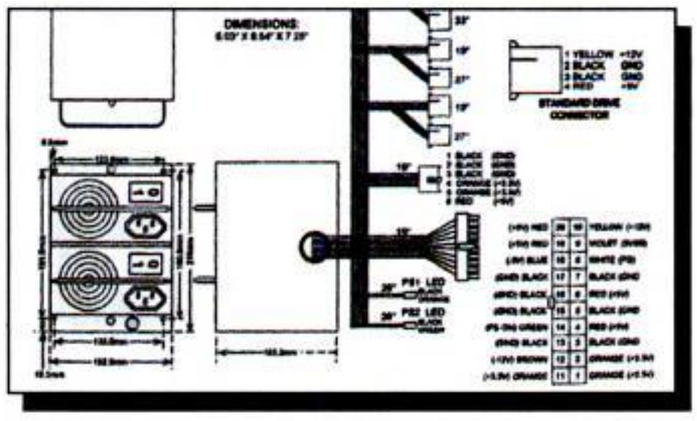

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▶ **Maximum PC takes a bite out of bad service and gear**

WATCHDOG

ILLUSTRATION BY SCOTT LAUMANN

Got a bone to pick with a vendor? Been spiked by a fly-by-night operation? Sic The Dog on them by writing Watchdog@maximumpc.com. The Dog promises to get to as many letters as possible, but only has four paws to work with.

INDIRECTWAVE

DEAR DOG: In December of 1997, I placed a phone order to DirectWave for a brand new 300MHz Pentium II PC. I sent them a money order for almost $3,000. The computer arrived four weeks later with a PCI videocard instead of the AGP card that I'd ordered. DirectWave said a new AGP card would be shipped, but the card never arrived. I called back and asked for an RMA to have the system returned by UPS. The company agreed and I was told to wait for a refund. I shipped the system back on Jan 10, 1998. Another two weeks passed and I still didn't get my money back, so I called again. The person said DirectWave had received my computer, and that the accounting department would issue the check to me. Ten days later, I called to check on the refund and the phones were disconnected! I sent a complaint letter to the Better Business Bureau, but the BBB said they couldn't find the company. Could you tell me what to do? How can I get my money back? I'm considering filing a suit but if I can't find them, what can I do?

—Hai Hsu Chien

"Ten days later, I called to check on the refund and the phones were disconnected!"

THE DOG RESPONDS: Bad news, Hai. After sniffing through available public-records databases, **THE DOG** has determined that DirectWave went belly up. On March 20, 1998, the company filed for chapter 7 to liquidate its assets.

According to the consumer site www.resellerratings.com, DirectWave earned rock-bottom scores from customers. Most who responded wrote that they'd never buy from the company again. According to the Better Business Bureau, 135 people filed complaints against DirectWave during the last three years the company was in business. Most dealt with the quality of service and components shipped.

Though there's only a slim chance you'll recoup any money, you should still file a claim with the U.S. Bankruptcy Court, Central District of California, Santa Ana Division. The case number is SA 98-14165 RA, and the address is 411 West Fourth Street, Santa Ana, CA, 92701, attn: Clerk's Office. Send a self-addressed, stamped envelope and request a copy of your claim. You can obtain claim form B-10 at www.uscourts.gov/bankform/formb10new.pdf.

AIR NO MORE

DEAR DOG: I have Advanced Integration Research's BXI3 motherboard with onboard SCSI. I recently went looking for an updated BIOS because I want to run a faster Celeron or Pentium III. I don't want to toss the board, because it cost more than $200 when it was new. AIR's web site is still up, but I haven't been able to access the BIOS files for weeks and no one answers the phone. Can you tell me what's up over there?

—Harold Lee

THE DOG RESPONDS: Alas, Advanced Integration Research, purveyors of motherboard products, is no more. Though a search of the net yielded no relevant news or chit-chat on AIR's demise, **THE DOG** managed to track down the company's president at his home. James Lee (no relation) tells The Dog that AIR closed its doors in 1998. "We don't sell motherboards anymore," Lee says. Why did AIR throw in the towel? "It's a very difficult business," Lee says.

But all is not lost. If you don't want to retire your motherboard, check out Unicore's BIOS updates at www.unicore.com. Updating your BIOS enables you to use such features as booting from the CD-ROM and installing different CPUs.

AIR Motherboard

MAX TYPO

DEAR DOG: In the November 1999 issue of *Maximum PC*, the inside front cover ad for Micron shows a Millennia MAX 600 for the bottom-line price of $2,234. A buddy of mine thought this was an awesome price, so he called Micron, using the 800 number from the ad. The customer service rep at Micron said that the price in the ad is a misprint.

Who deserves to lose a pound of flesh from the old gluteus max, Micron or Maximus PC?

—Frank Dell'Aquila

THE DOG RESPONDS: Maximus PC gluteus stays phat and intact. **THE DOG** blames the screw-up on optimistic forecasts, and on a blatant typo by Micron's ad department. After all, who wouldn't want a Millennia Max with a 600MHz P-III, 19-inch Trinitron monitor, 8x DVD, nVidia GeForce, and 256MB of PC133 RAM, all for a measly $2,234? Heck, even The Dog tried to pick up one those puppies. What's the real price? $2,800. Ouch. Part of the price difference can be attributed to the spike in RAM prices and the huge demand for the MAX. But a majority of the difference is due to pure screwup, Micron officials tell The Dog.

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Can you demand to purchase an item for the price at which it was advertised? You're generally out of luck, says legal eagle Robert Massi. Massi, a consumer legal analyst for Fox News, says most people believe they have a right to buy at the advertised price, but that generally, they don't.

"An ad is not a contract, it is nothing more than what it is—an enticement article," Massi tells The Dog. Unless there's a clear-cut case of intentional false advertising, consumers don't really have a leg to stand on. And even in clear-cut cases, filing civil suits against corporations is a time and money suck that few individuals can afford.

Massi does urge consumers to stop being milksops when a store or company won't sell an item at the advertised price. When confronted with a price or equipment change, most people simply lower their heads and buy it, Massi says, instead of doing the right thing and shopping elsewhere.

The Dog advises you not to let vendors push you around. If you don't receive your merchandise in a timely and reasonable manner, don't let the store string you along for six months. Instead, call your credit card company and dispute the charges.

CAN'T GET NO SATISFACTION

DEAR DOG: More than four months ago, we ordered a computer from Microworkz.com, after reading a review about their econo-computers in another magazine. The $400 charge was made to my boss' credit card almost immediately, but three weeks went by and no computer was delivered. When I called Microworkz, they could not even give me an estimate as to when the computer would be shipped, so we cancelled the order. We were told they would issue a refund, but months have passed and we still have not received one. I can't even get these people on the phone. Their web site is still operating—it's obviously a scam that needs to be shut down. We want our money back, and we also don't want to see anyone else ripped off.

—Frank J. Liess

THE DOG RESPONDS: Another reader, Jennifer Gregory, had similar problems:

"In July, I ordered a [Microworkz] PC and was told I would receive it within four weeks. It did not arrive, and I ended up canceling the order. It's October now, and I still have not received the credit for the computer that I never received."

These were the first of several complaints **THE DOG** received from folks who said they couldn't get satisfaction from Microworkz. What's the story? The Dog chewed bones with Microworkz CEO Rick Latman and Chief Operating Officer Lance Rosen. Latman told The Dog that the problems are a side effect of the company's transition from a direct-seller business model to a distributor business model. In fact, in late September, the company stopped taking direct orders for super-cheap PCs on its web site, and instead began directing people to stores that sell the PCs.

Latman believes a few individuals fell through the cracks during the transition, and promised to have someone fast-track Maximum PC readers' problems through the system. He says Microworkz's problems are indicative of the entire direct seller, free/cheap PC phenomenon, something he believes may not be rooted in reality.

Latman and Rosen say the blame absolutely lays at the feet of Microworkz.

"It was a disaster," Latman says of the company's business model, which crashed and burned when demand for its PCs surged out of control. "We weren't prepared for the success."

Rosen says Microworkz takes all the blame, and hopes customers will understand. "We cop to the fact that we made big mistakes," Rosen tells The Dog. "We are in the process of repairing all those relationships. The failure was not on the fault of our customers or suppliers, it was our lack of experience." Rosen says refunds have been slower than expected, but promises that the process will continue until everyone is taken care of.

"There's a pending investigation."

But Microworkz's problems have already gotten the attention of law enforcement. The Washington State Attorney General's Office confirmed that it plans to investigate whether the company violated state consumer protection laws.

"We're certainly looking at Microworkz," says Janice Marich, a spokeswoman with the Office of the Washington State Attorney General. "There's a pending investigation."

Marich says about 62 complaints have been filed with the office. Most centered on Microworkz's inability to ship products or refund payments, or concerned systems that simply did not meet consumers' expectations, Marich says. She encouraged consumers with outstanding complaints against Microworkz to contact their Attorney General or the Washington State AG. Complaint forms and contact information for the Washington AG is available at www.wa.gov/ago/. Watch this space for news of any pending law enforcement actions against Microworkz. Woof.

CHECK IT OUT online
www.maximumpcmag.com

DOG BITES

Quite a few people have written to The Dog regarding the version of 3dfx's fastest card, the Voodoo^3 3500, that's bundled with OEM systems. Many say they expected to receive a system containing the Voodoo^3 3500 equipped with a TV tuner; instead, they got the bare version of the card. Here's the poop straight from 3dfx: The TV/FM tuner version of the card is called the 3500TV, and is available on store shelves and in new systems. Another version of the card is offered by OEMs; it's called the Voodoo^3 3500, 3500C (for Compaq), or 3500D (for Dell). These cards are not sold in stores and are not equipped with the TV or FM tuner, but they do have the faster memory and core of the 3500TV. If your heart is set on the card with the TV tuner, be sure to ask your vendor whether your system will include one.

Voodoo^3 3500

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PERIPHERAL VISION

QX3 PC Microscope

Intel's QX3 looks like a slimmed-down version of that robot from *Lost in Space*, but it's actually a hand-held microscope that can be used to view just about anything up close and personal. Unlike traditional lab microscopes, the QX3 doesn't contain an ocular lens; instead, it projects images onto your PC's monitor. The QX3's eight-foot-long USB cord provides a pretty wide range of viewing possibilities, and the bundled containment dishes are just perfect for holding onto any specimens you plan to view. Use the QX3 to zoom in on and magnify images up to 200 times their original size, adjust the focus and lighting, then take a snapshot of your specimen. Add some special effects, modify the image using the included paint program, choose a musical score, and boom, you've got your own science slide show. Ours included the tour we took up our collective nostrils—there's some fascinating stuff going on in there.

$100; Mattel; www.intelplay.com; 888.628.8359

You can play a mean game of "I spy with my little eye" using the QX3's nifty containment dishes and 200X magnifying lens.

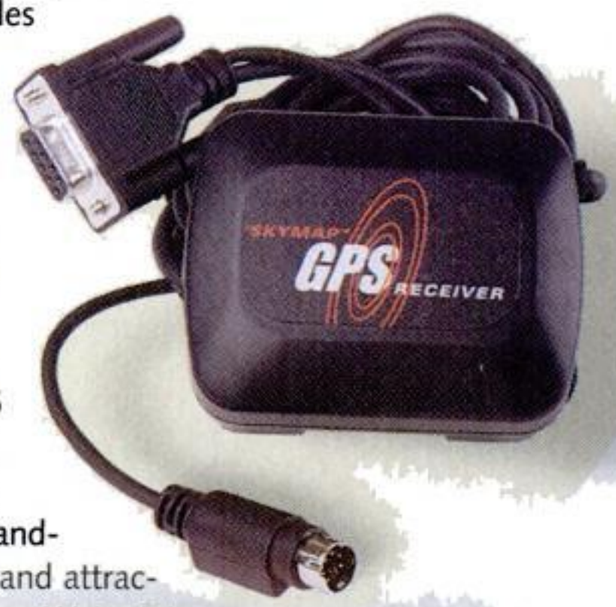
CapShare 820 Portable eCopier

Desperate to copy something on the run? Hewlett Packard's CapShare Portable eCopier can scan and store up to 50 pages that can then be printed via infrared port. The data can also be downloaded onto your PC, for OCR or editing. CapShare can do things an ordinary copier can't, such as scanning the contents of an entire flip chart that's hung on the wall. Documents can be reviewed on the monochrome screen immediately after you've scanned them. The CapShare is amazingly miserly about power, functioning on two rechargeable AA nickel metal hydride batteries—or you can switch to AA alkaline batteries in a pinch.

$499; Hewlett Packard; www.capshare.hp.com; 208.333.5759

SkyMap 2000 GPS System

Thanks to Sony's SkyMap 2000 GPS System, you'll never again have the, "We should ask for directions" argument. This GPS system for your car includes everything you'll possibly need to get back on the road with your machismo intact. In addition to the 12-channel GPS receiver, SkyMap 2000 bundles 275 digitized, regional street maps, each detailing myriad landmarks and attractions. We're into cars, so we appreciated the 274,000-strong compendium of auto dealerships and services, but we're also snappy dressers, so the list of 622,000 shopping malls and high-priced boutiques was handy, too. You can even download maps directly to your Palm PDA. For an additional subscription fee, SkyMap 2000 can also provide realtime traffic and weather reports. Hook the GPS receiver up to a notebook for step-by-step audio instructions as you're driving—along with the answers to such pressing questions as, "Where's the closest McDonald's?"



$300; Sony; www.sony.com; 888.531-7669

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Part Professor.
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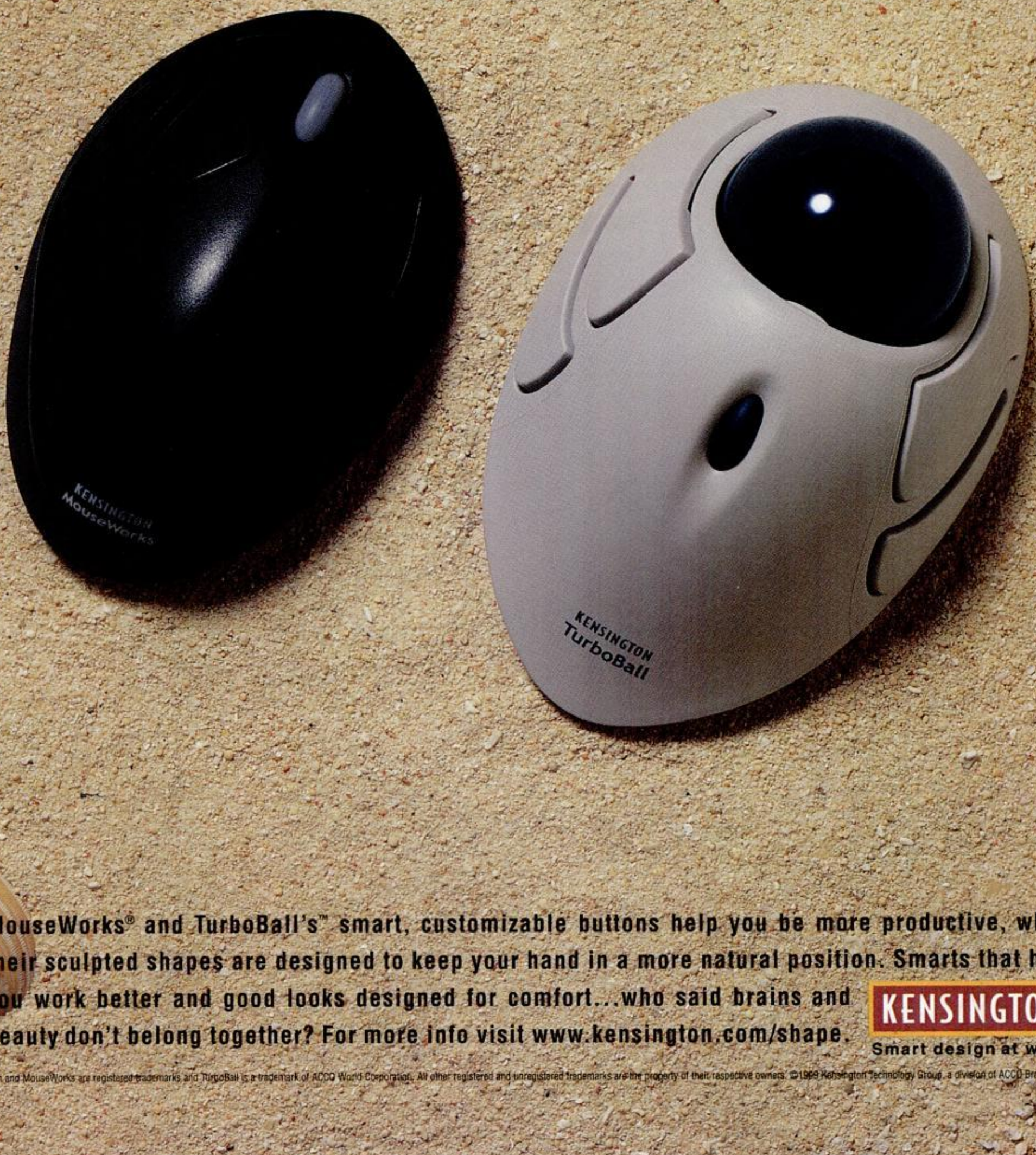

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System of the Year

MAXIMUM PC

December 1999

AMD Athlon PROCESSOR

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- CyberMax 19"(.26dp-18"VA) Monitor
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- Aureal Vortex2 PCI Sound Card w/ A3D 2.0 Technology
- Altec Lansing ACS33 Powercube Speakers w/ Subwoofer
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- V.90 Standard 56K Fax/Modem
- Aureal Vortex2 PCI Sound Card w/ A3D 2.0 Technology
- Altec Lansing ACS33 Powercube Speakers w/ Subwoofer
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- CyberMax 19"(.26dp-18"VA) Monitor
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- V.90 Standard 56K Fax/Modem
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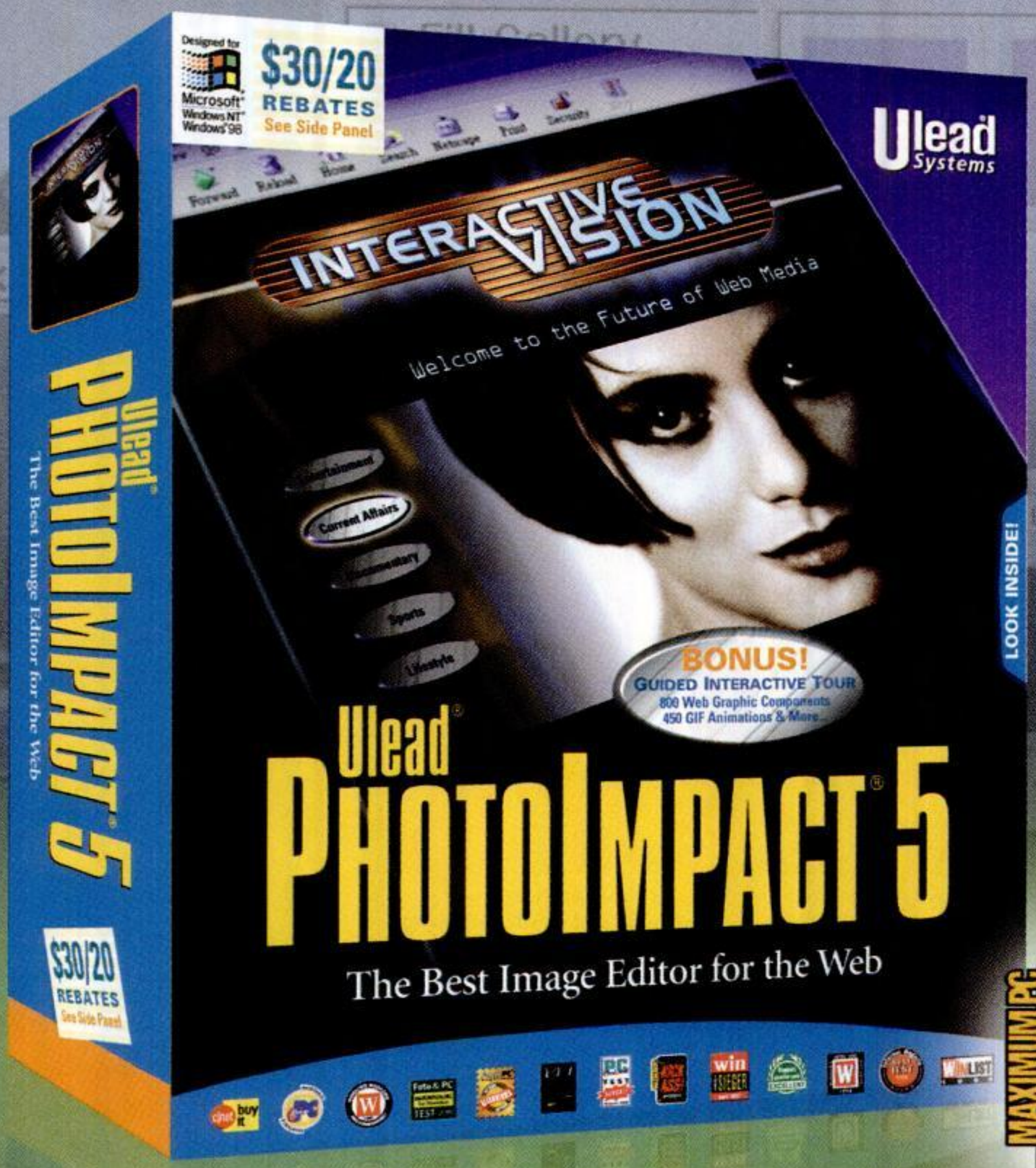

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▶ TOMORROW'S TECHNOLOGIES EXPLAINED

FAST FORWARD

Swinging the SledgeHammer

AMD'S 64-BIT ALTERNATIVE TO INTEL

When it comes to CPUs, more bits is better, right? It stands to reason that if a 32-bit processor is better than a 16-bit processor, a 64-bit processor is better than a 32-bit processor. Or is it?

The answer may surprise you—and help you to decide what computer to buy in 2001.

CPU inflation has a long history. The world's first microprocessor, Intel's 4004 4-bit chip, debuted in 1971. It was soon followed by the 8008 and 8080, both 8-bit processors. The first chip in the x86 family was Intel's 8086, a 16-bit CPU that powered the original IBM PC. The x86 expanded to 32 bits in 1985, with Intel's 386. All of today's x86 chips are still 32 bits, including Intel's Celeron, Pentium II, and Pentium III; AMD's K6 and Athlon; Cyrix's M II; and Centaur's WinChip.

Now, AMD has launched a daring plan to stretch the x86 to 64 bits. AMD's future K8 processor—recently renamed the SledgeHammer—is scheduled to hit the market in 2001 as the world's first 64-bit x86 processor.

It may seem odd that AMD, and not Intel, is striving toward this landmark. After all, Intel invented the x86, owns the most important x86 patents, and sells more x86 chips than everyone else put together, times four. But Intel has no known plans to expand the x86 to 64 bits, intending instead to improve its 32-bit chips while introducing a whole new 64-bit architecture called IA-64. Merced, now known as Itanium, will be the first IA-64 chip when it appears in mid-2000.

Thus, we find two of the world's largest chipmakers taking different forks in the road—but both paths have potholes.

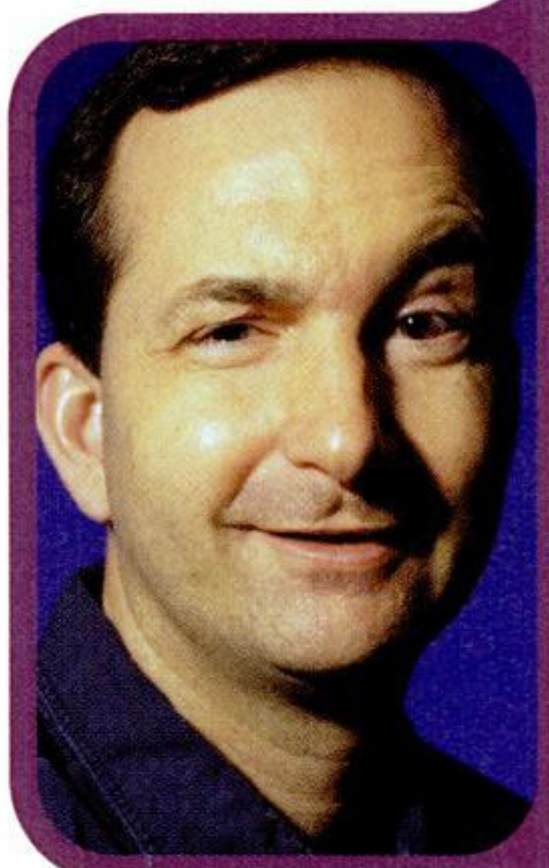
Intel's IA-64 requires new operating systems and software because it's completely different from the x86. Though IA-64 chips can run existing x86 software by translating the program instructions internally, even Intel admits that Itanium won't run x86 software as fast as the leading x86 processors do. That's where AMD sees an opening: SledgeHammer will remain x86 compatible while expanding some of the instructions, registers, datapaths, and memory addressing to 64 bits. That means SledgeHammer can handle data chunks twice as large as those that today's x86 chips can handle, and it can access much more memory. AMD is also making even-more-radical improvements to the x86's outdated floating-point architecture, so SledgeHammer should be faster than 32-bit x86 processors for 3D graphics and other math-intensive tasks. Theoretically, SledgeHammer will deliver better performance and eliminate the need to switch to IA-64, which is likely to be very expensive for several years.

We find two of the world's largest chipmakers taking different forks in the road—but both paths have potholes.

On the other hand, SledgeHammer—like IA-64—still requires you to upgrade your operating system and software in order to get maximum performance. Existing 32-bit software can't take advantage of 64-bit features until software developers recompile their programs for 64 bits. In that respect, it's similar to the current situation with multimedia extensions such as AMD's 3DNow! and Intel's SSE—you can't teach an old program new tricks. There's also a financial consideration: AMD is swinging SledgeHammer at the high-profit server market, not the low-profit desktop PC market. Expect to pay a hefty premium if you want to replace your ballpeen-hammer PC with a SledgeHammer.

Perhaps the biggest bump on AMD's road is the nagging question, Who really needs 64 bits? Big database servers and the like will benefit, but for everyday computing and 3D graphics, multimedia extensions can actually make a greater impact than a 64-bit architecture. For example, 3DNow! already crunches data in 64-bit chunks, even though the K6 and Athlon are 32-bit processors. (It would take another whole page to explain why.) SSE does even better, crunching data in 128-bit chunks on the 32-bit Pentium III.

Over time, 64-bit chips will drop in price, and eventually, you'll probably travel down that road. But there's no reason to rush. You don't need a SledgeHammer to swat a fly. ✹



TOM HALFHILL
was senior editor at Byte magazine and is regarded as one of the most knowledgeable experts on processor technology in the industry. Contact him at **thalfhill@maximumpc.com.**

Random Thoughts

▶ Digital cameras aren't the only digital imaging solution. A low-end film scanner can deliver much higher resolution at a fraction of the cost. For instance, Hewlett-Packard's PhotoSmart scans 35mm slides and negatives at 2400 dpi, which yields a maximum resolution of more than 8.6 million pixels—four to eight times as much as a typical megapixel camera. Yet it costs about half as much as some megapixel cameras.

▶ The recently proposed USB 2.0 specification boosts the speed of the interface by 30 or 40 times that of today's USB standard. That would put USB on an equal footing with today's IEEE 1394 FireWire interface. But digital camcorders will probably stick with FireWire, so you'd still need both interfaces for video editing.

▶ Why bother with bookmarks? Put your favorite links into a simple HTML page and make it your default browser home page. For an example, see **www.hooked.net/~halfhill/tompage.html**.

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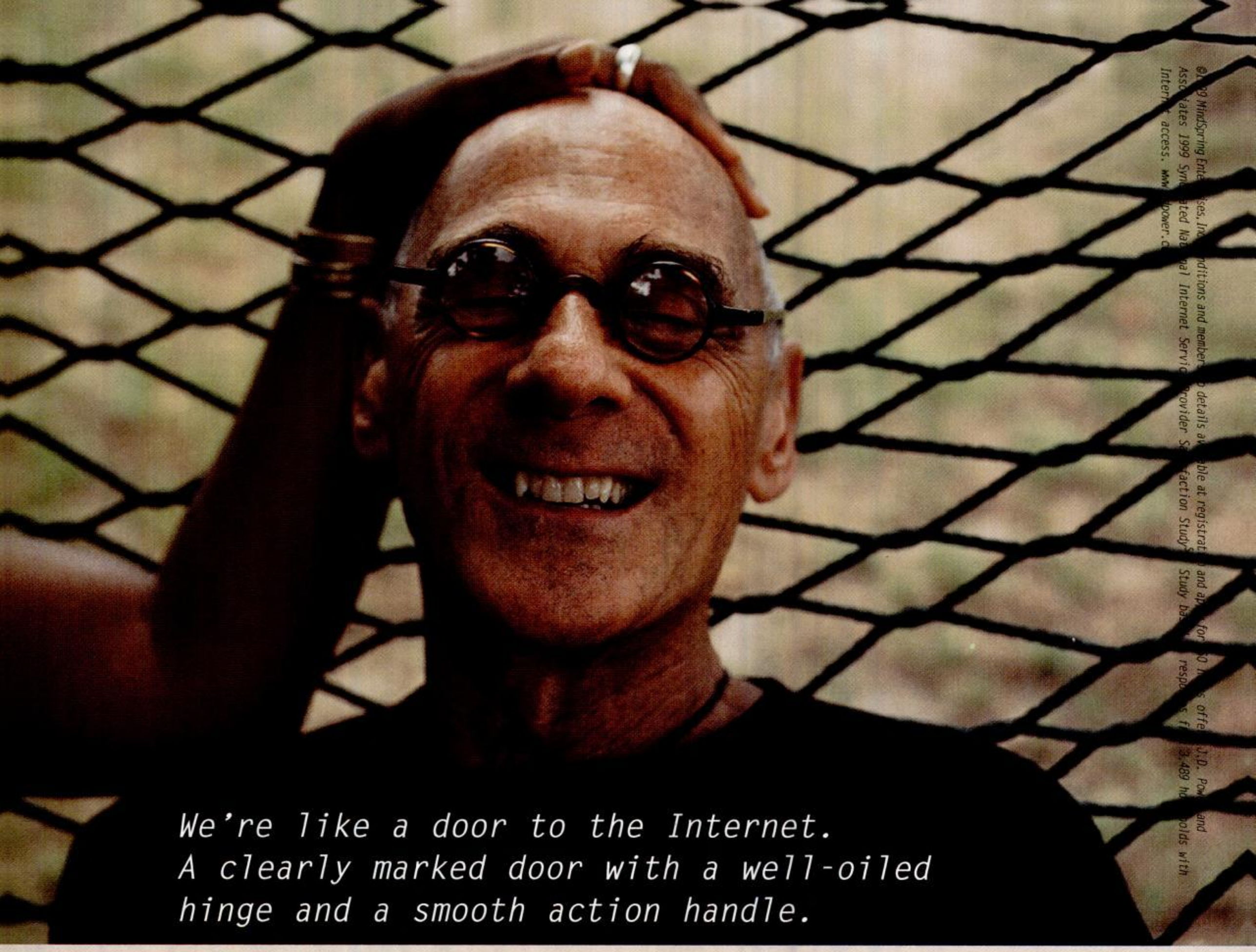

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▶ GETTING MORE FROM YOUR TIME ONLINE

NET SENSEI

Don't Make Me Hate You

WEB SITE DESIGN MISTAKES—AND WHAT TO DO ABOUT THEM

I just came back from a long, tiring trip through 100 Tripod and Geocities member pages that specifically mentioned this mag. One of the worst called itself "the future of web design." That was my call to action.

IMHO, the beauty of the web is that it's the only medium through which *anybody* can publish. On the flipside, the thing I hate most about the web is that *anybody* can publish to it—filling it to the brim with ugly, unreadable, useless, wastes of valuable time.

As a web-design avenger, I hate every single one of you who are guilty of creating a digital compost heap. If you want off my humus list, I suggest you follow these tips and clean it up:

Got Content? Put it where I can see it. It is beyond me why anyone thinks it's a good idea to put a huge "logo" at the top of the page, then a picture of a cartoon character with a flat head, then some babble, then some fake awards, and on and on and on, until finally including some content and/or a navigational scheme of the site. Even some of *Maximum PC*'s web affiliates are guilty of this crime.

Bring your navigation to the top! People don't like to scroll, and one glance at a page with gothic lettering and a Dilbert cartoon tells the reader, "There's no content here." And that ditch-digging dude is diggin' your site's grave—as he waves his "under construction" shovel, I'm waving goodbye, because it's another sure sign that there's no content. Don't make excuses for your "mess," because it just draws attention to it. Last content note: If all you have to give me are links, tell me what they're linking to and why you put them there. You're not Roger Ebert, so your endorsement by simply providing a link doesn't mean squat to me. A list of 50 links is far more valuable when you tell people, in your own words, what they're about to launch out to.

Graphic Mishaps Scale graphics in the software in which you created them, not in HTML! Last night, I waited 15 minutes to see a 127K graphic scaled to 30 pixels wide. I could have waited 15 seconds for a 5K JPEG of the same thing. If you want thumbnails that spring to larger graphics and you're too lazy to create two separate file sizes, use the Automate > Web Photo Gallery feature in *Photoshop 5.5* to do it automatically. Of course, while some designers make pics too big, others make them too small. You are hereby informed: The new viewable-area standard is 600x800, not 480x640. Only 13% of all surfers still cling to the latter, so unless you've got a really good reason to target that 13%, I suggest you cater to the larger audience.

Cast Against Type Contrast, contrast, contrast. Quit picking a type color that's one hex value different from the color of your background. And if you want more guys looking at your stuff, consider this: 25% of all men are colorblind to some degree. Your red text on blue background is invisible to them.

Again on the topic of gothic lettering: Kitschy type is ugly, childish, and in most cases, unreadable. For some links to free web fonts that don't suck, check out **www.lightlink.com/xine/graphic.html**. This homespun site also provides links to other thoughtfully selected web design resources, such as syntax checkers and color tables. FYI, the font tag is going away in upcoming browsers, to be replaced by CSS as the new standard. Get used to it now.

The Insufferable Tripod Webtool It allows you to create web sites for free and doesn't require HTML knowledge, but Tripod appears to be some kind of wicked joke designed to generate bad-looking pages. With only 18 colors to choose from (the only readable combination being black on white or vice-versa), a selection of background patterns containing schizophrenic shifts in hue and saturation, and no navigation builder, it's nearly impossible to create a user-friendly web site using this thing.

Selling Something? If you're not into e-commerce, at least give me real info. Restaurants, I want your menus; online reservations would be even better. If you're selling products and services, e-commerce is a must—I'm *not* calling your 800 number, I'm *not* faxing any forms to you, and neither are countless other potential customers. Your ISP is probably equipped to enable you to make credit-card transactions and utilize other e-commerce tools—without you having to learn to code. If not, there are hundreds of places on the web that can set you up; the best help I found is at Virtualis (**www.virtualis.com**), where packages start at $36 a month.

One last note: Do me a favor. Don't put links to Dilbert and *Maximum PC* on the same page. Now, let's be friends again.

I hate every single one of you who are guilty of creating a digital compost heap.

SHERRY MONARKO has used the Internet for everything from ordering pizza to getting married. She is currently Lead Online Designer for Imagine Media's Computers & Technology Division. Contact her at **smonarko@maximumpc.com.**

Random Thoughts

These days, it's not a question of what can be bought online; it's what can't be. Here's a list of odd shopping sites I came across this month:

▶ World Class, **www.worldclass.com** Choose from Russian, Ukrainian, Chinese, or Columbian mail-order brides. The site bills itself as a resource "for single, professional, and technical men of discerning taste."

▶ The Boneroom, **www.boneroom.com** Human ribs start at just $8. A full skeleton costs $2,500. "Be sure to let us know of your special requests, because bones are as individual as you are."

▶ Ron's Angels, **www.ronsangels.com** Bid on the ova of "beautiful, healthy, and intelligent women." Desirable sperm coming soon.

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Don't worry, at NVIDIA, amazingly fast, cutting-edge graphics processors are all we do. The results are ultra-smooth frame rates and incredibly vivid colors that allow you to see and play 3D/2D games exactly the way game makers intended. Not to mention an Internet experience that comes to life. If you demand this kind of performance out of your games and the Internet, then demand your next PC or graphics accelerator comes loaded with a NVIDIA chip. There's no reason to settle for anything less. Graphics to the nth degree.

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▶ THE SCOOP FROM A MAJOR PLAYER

GAME THEORY

Watch out, Goliath

FOR GAMERS, LINUX HAS A LOT TO OFFER

You've heard about it, wondered about it, maybe even been intrigued by the idea of it. The notion of de-Microsofting your machine seems mighty appealing—and that penguin is just so damned cute. But what is Linux really about? What are its advantages, what are its pitfalls, and where does gaming enter the picture? Heady questions, these, and the answers are complex, important, and to some degree, uncertain. One thing is for sure: Linux has a place in the future of gaming.

The story of Linux is the stuff of legend. Linus Torvalds created the Linux kernel in 1991 and released the source code to the public, giving a major boost to the open source movement. Users the world over can tweak, expand, and otherwise modify the Linux code to create an ever-evolving, free OS.

Linux is something of a second cousin to UNIX. Like UNIX, Linux's network code is integral, making it the strongest platform available for servers, networking, and multitasking. Its network code leaves everything else in the dust—especially Windows. A Linux server can run almost indefinitely without a hard crash, and with more servers moving to Linux, online gamers are increasingly encountering Linux without noticing anything different—except the increased stability of their connections.

If you're not running a server, installing Linux on your main machine probably won't give you much more than a throbbing headache. Linux may be engagingly customizable and stable, but it lacks a slick GUI (though GUIs are being made for it), and support for software and hardware is the pits. Aside from kitchen-sink productions and a growing shelf of games, there are few native programs. You can download the whole OS for free and install it yourself, but if you're not a UNIX expert, you'll soon be reaching for that Windows 98 restore disc. Companies such as Red Hat have put bundled, user-friendly installation packages onto retail shelves, but Linux is an evolving system. When it comes of age, it could shake things up big—but that's not going to happen yet, at least not for the average consumer gamer.

With more servers moving to Linux, online gamers are increasingly encountering Linux without noticing anything different—except the increased stability of their connections.

More and more games are making their way to Linux users. Some are company ports, such as id's *Quake* for Linux. Others are third-party ports, such as Loki Entertainment's proliferation of titles, including *Railroad Tycoon II, Heroes of Might and Magic III, Civilization: Call to Power,* and *Myth II.* These games run pretty well; Loki is implementing inventive solutions to API problems, and support for hardware accelerators is good, although sound support is still quite weak. The major problem plaguing these titles is the user customization required to keep these games—and, for that matter, a whole Linux system—running. Users need to get into the OS's guts and screw around with files and codes. Init files must be manually configured, and the code must be recompiled with each new driver. For early Linux adopters, these tasks are part of the appeal. For most consumers, they're a nightmare that makes OS/2 look like a day at the beach, but with a lot less payoff.

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Since you're a *Maximum PC* reader, you're obviously a power user. You may be a professional power user, but there's a good chance that your PC passion is a hobby; you simply want the newest, hottest components that will deliver the best gaming performance. Configuring your main machine for Linux is probably out of the question, but if you have some Pentium components lying around, building a second Linux box might be well worth your while. Linux works well on even an old P60; though *Quake* ain't exactly going to soar, it will at least give you a chance to muck about with a good OS and get a feel for how it works.

The OS industry is currently in an odd state of flux. With Microsoft facing serious legal issues, the time is right for a challenger to arise, and Linux is the perfect David for the MS Goliath. Windows is a flat-out mess, and we only use it because we have to. It's terrible as a server, very unstable, and a system hog. For something as crucial as an OS, the world should not be enslaved to the machinations of one consumer-hostile company. Will an army of home programmers ever challenge the MS machine? A year ago I would have said never. Now, I'm not so sure.

Linux is decidedly user-unfriendly right now, but it has the potential to be something much more, particularly in the world of online gaming. Plus, it's not in the iron grip of one man. It's one of those power-to-the-people things. ✹

Random Thoughts

▶ **Best Game of the Year?** Some major products have yet to ship, but it's hard to imagine any games being better than *Homeworld*, *Freespace 2*, or *System Shock 2*. If I had to pick, I'd choose *Homeworld*—it's so damn innovative. *Freespace 2* is essentially Son of *Wing Commander*, but it still rocks hard. *System Shock 2* is just a thrill from start to finish.

▶ **Worst Game of the Year?** Cheap shots would be easy: Pick any bullrider/hunting/Wizardworks/GT Budget game and insert here. But more interesting are major studio messes such as *Kingpin* and *Tiberian Sun*, which prove that lots of time and big budgets can still produce indifferent results.

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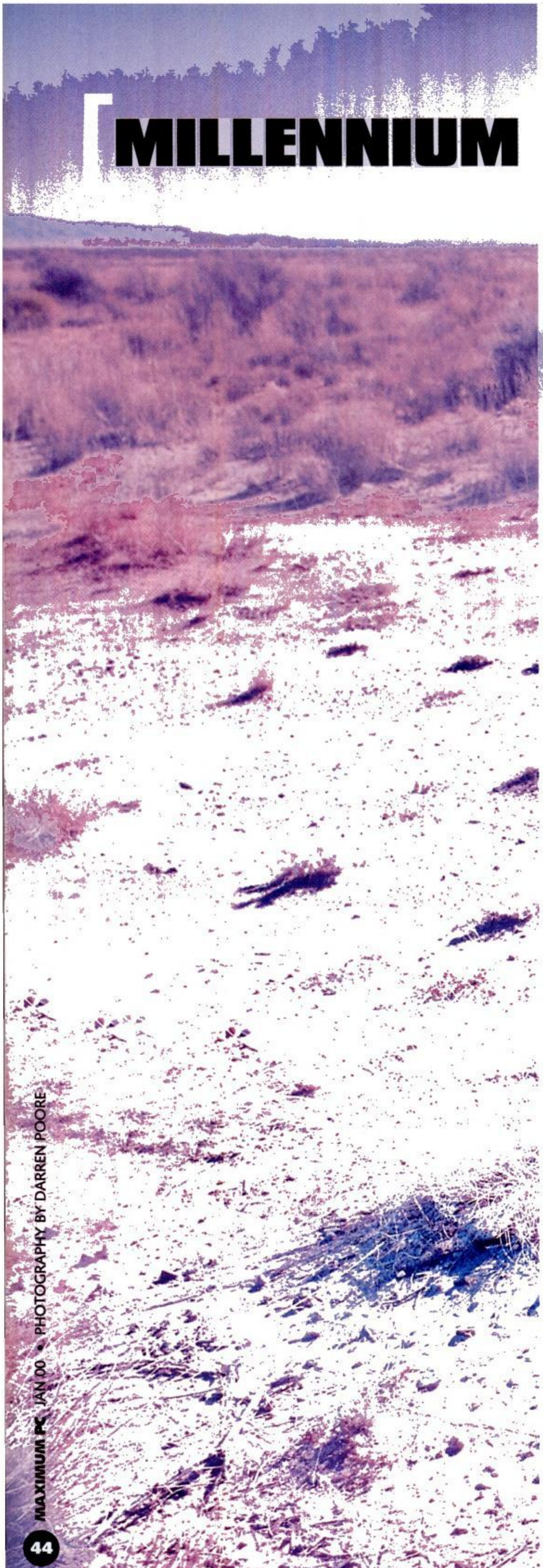
MILLENNIUM SURVIVAL GUIDE



You survived the Y2K apocalypse, but the true test of your mettle lies ahead. The new PC landscape is hostile and unforgiving—so to make the right decisions, you need to learn what the future holds. Be prepared, road warrior, be very prepared...

Welcome to 2000, the age of gigahertz processors, 64-bit operating systems, and enough high-speed net access to connect every highly evolved organism from here to Roswell and back to the Terrordome. Sure, the new millennium offers technology galore, but none of it means jack if you don't upgrade wisely. From where you're standing now, the tundra may look bleak and foreboding—but rest assured, there are safe ways out.

Herein lie the answers to your most pressing PC questions. Not only have we previewed all the brave new developments in each technology category, we've also provided survival plans to help you get through the next 1,000 years (or at least the next 12 months). Use this info wisely as you wind your way toward PC certainty. And don't forget your night-vision goggles—the sun sets early around these parts.

Which videocard should I buy this year?

No single videocard will rule the 3D scene for all of 2000. Instead, new 3D architectures will leapfrog one another—nVidia's GeForce will be surpassed in speed by ATI's Rage Fury Maxx, which in turn will be smacked down by 3dfx's Voodoo^5, which will hold its own until the arrival of nVidia's GeForce Pro (or whatever they call the 0.18-micron version of GeForce), and so on. When you consider how similar videocard feature sets have been over the past year, this is a good thing. The homogeny of 1999 videocard features will give way in 2000 to graphics processors that are full of more innovative features than game developers—and consumers—know what to do with. New technologies, such as hardware transform and lighting, multiple processor configurations, and embedded memory will keep the 3D landscape changing throughout 2000.

▶ **SURVIVAL PLAN:** Hang tight until the fall of 2000, which is when the biggest, fastest, most brazenly flamboyant 3D guns will arrive.

Will I see photo-realistic, Toy Story-quality 3D graphics from my videocard this year?

No, it will be another five years before your videocard pumps out *Toy Story*-quality 3D in realtime. Remember, *Toy Story* was rendered by hundreds of high-end graphics workstations that logged hundreds, if not thousands, of hours chugging through ray-traced graphics. For a PC to pull that kind of power, the videocard needs to push at least 800 million triangles per second at 1280x1024 in 32-bit color without dipping below 60fps. nVidia's GeForce—the current triangle-rate champ—pushes just 15 million triangles, and they definitely aren't ray-traced. Ray-traced rendering tracks and displays every possible reflection, refraction, and shadow caused by the light bouncing around a 3D scene. It's incredibly floating-point intensive, and well beyond the reach of current rendering

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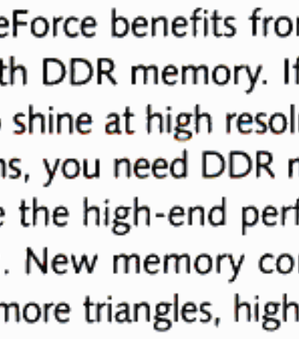
architectures. While videocards are slowly but surely heading towards that level of quality, this year's crop of cards just won't make it that far.

They will, however, hit outrageous fill rates. 3dfx's four-chip, 128MB Voodoo^5 6000 will kick off this year's fill-rate competition at a whopping 1.3 gigapixels per second. Gigapixel fill rates, combined with high-resolution textures and such new features as quad-multitexturing, full-scene anti-aliasing, 3D textures, and vertex blending, will take next year's 3D graphics a long way toward photo-realistic quality. But the real race in the latter part of 2000 will be to match monstrous fill rates with higher triangle rates. The only way to do that is through hardware transform and lighting. nVidia and S3 already have hardware T&L products, and you can bet all the big 3D players in the sandbox are hard at work on hardware T&L castles, though you won't see them until later this year.

Of course, the combination of higher clock speeds, additional rendering pipelines, and integrated T&L engines will increase the need for faster memory technologies, such as double data rate (DDR) SGRAM, Rambus RDRAM, and embedded SDRAM. Old school SDRAM just can't keep up with next-gen graphics processors. If you need an example, check out the degree to which nVidia's GeForce benefits from its partnership with DDR memory. If you want GeForce to shine at high resolutions and color depths, you need DDR memory to alleviate the high-end performance bottleneck. New memory configurations will allow more triangles, higher fill rates, and buttery-smooth frame rates to fill your screen. Without a doubt, it will be through faster memory technologies that the new features and capabilities of next year's graphics chips will be fully realized.

▶ **SURVIVAL PLAN**: If you really want to see *Toy Story*-quality graphics, ingest some post-apocalyptic nuclear cacti. You'll be seeing things, big-time.



Will PCs replace VCRs this year?

All indications are that PCs won't replace VCRs anytime soon, although new technologies are certainly making the venerable VCR seem outdated. Digital VCRs, which are essentially PCs in a box, will rise in popularity this year as their prices fall—and as the controversy subsides. A coalition of television network executives got their panties in a wad last year when the first digital VCRs, the Tivo and Replay, were released. The execs said the devices infringed upon the rights of TV networks, since the personal video recorders (PVRs) filtered the freely broadcasted network content. Regardless, Forrester Research estimates that the rise of PVRs will lead to a 50% decline in TV-ad watching over the next ten years—a much bigger reason for the suits to wad (or soil) their panties.

Both the Tivo and the Replay offer MPEG-2 decoding, as well as freeze frame, rewind, and even slow motion—all intended for use during live TV broadcasts. PVRs' killer-app feature is time shift, which enables you to rewind the program you're currently watching while still recording the remainder of the show—so, if a phone call interrupts "Buffy," you can easily go back and watch what you missed without missing the rest of the program. PVRs' biggest limitation, however, is their storage space, because recorded programs reside on an internal hard drive. Tivo's base model offers up to 10 hours of recording time; ReplayTV's model packs away up to 20 hours of programming goodness.

Several PC hardware manufacturers, particularly ATI, are working to bring PVR technology directly to the PC. Due to the technology's immaturity, ATI is playing it safe and keeping mum on the details about the ATI Video Wonder, its first card slated to offer time shift.

We do know that developing the Video Wonder is proving to be more difficult than ATI originally imagined, especially since it's also spec'd to encode and decode MPEG-2, capture video, and function as a TV tuner. ATI hasn't indicated when all these fancy new features will make it to the All-in-Wonder, but you can bet ATI's engineers are working their little butts off to make it happen next year.

The holy grail of these advancements is the ability to make your own DVD movies. Just as digital VCRs will take the place of analog tape devices, the DVD standard will surely replace the aging CD-ROM format. The technology that will merge the digital VCR with DVD is DVD+RW. Sadly, DVD+RW won't appear for at least another year, due to the CD-ROMs' current stronghold in the consumer space. But once DVD+RW drives make it into the spotlight, consumers will be able to back up old VHS tapes, make their own DVD movies (after a lot of mastering, of course), and burn massive quantities of television programming in high quality MPEG-2 format, for storage and sharing.

▶ **SURVIVAL PLAN**: Don't barter your VCR for cans of Vienna sausages unless you're willing to survive 2000 without your Andrew Blake collection.

Where is DVD+RW?

Optical storage aficionados are eagerly awaiting the arrival of drives that allow recording onto 3GB DVD+RW media. We're sorry to say that they'll have to wait a bit longer than originally anticipated. Three vendors—Sony, Philips, and HP—were planning to release the first DVD+RW drives by the end of 1999, allowing folks to record MPEG-2 video, or anything else, directly onto DVD media for playback on any DVD drive. All three DVD+RW manufacturers have decided not to release the drives for the time being, skipping the DVD+RW 3GB format to focus instead on the release of 4.7GB disks, since they'll be compatible with all DVD-ROM drives (the 3GB format is only compatible with newer drives).

This is quite a different approach than what Panasonic has taken with its cartridge-based DVD-RAM drive, which allows recorded material to be played back only on other DVD-RAM drives. DVD+RW proponents believe backwards compatibility with DVD discs of any kind will ultimately allow the DVD+RW spec to proliferate, though they also believe that, due to the strong activity of CD-R and small installed user base of DVD, the market isn't ready for DVD+RW. How far in the future is the release date? It's up to speculation, though an official at Sony estimated approximately 12 months from the time you read this, pegging the release in early 2001.

▶ **SURVIVAL PLAN**: Hang onto your CD recorders, folks. DVD will remain a read-only proposition in 2000.

Are CD-ROM drives dead?

Last year, we predicted that as a result of DVD's arrival, the CD-ROM drive would go the way of the Dodo. A year has passed, and DVD hasn't taken over like we thought it would. Regardless, we're prepared to say again that the CD-ROM drive will die this year—but it won't be DVD's popularity that kills it. Rather, the

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proliferation of CD-R will bring about the CD-ROM's demise.

The lifespan of most storage products usually includes three stages: storage, sharing, and, finally, becoming a standard. Currently, CD-ROM has reached the "standard" stage, a sure sign that it's at the end of its lifespan. CD-R is the next logical step. Though it first emerged as a novelty, and was used strictly for storage purposes, the CD-R installed user base has increased substantially. The MP3 phenomenon has taken off like a ballistic missile, so CD-Rs are now used for recording music CDs and playing them elsewhere. In response to the surge of interest in CD recording and MP3 stealing—er, recording—most vendors are jumping on the bandwagon in 2000 and releasing very affordable CD-R/RW drives. Even Plextor, a company that once made only top-end SCSI drives, is entering the fray with an IDE CD-RW.

► **SURVIVAL PLAN**: CD recorders will continue to offer even faster read times and lower prices—so there's no compelling reason to consider a plain-Jane CD reader.

"Without a doubt, it will be through faster memory technologies that the new features and capabilities of next year's videocards will be realized. New memory configurations will allow more triangles, higher fill rates, and buttery-smooth frame rates to fill your screen."

HARD DRIVES

Does SCSI matter anymore?

While ATA/66 is fast, it doesn't hold a candle to the 160MB/sec peak burst rates offered by SCSI's upcoming Ultra 160 protocol. Ultra 160 doubles the current Ultra2 SCSI throughputs, while increasing data reliability through improved redundancy checking. SCSI always strives to stay three times faster than current hard drive speeds, in order to work better in multiple device configurations and RAID arrays. Since hard drive speeds should hit 40 to 50MB/s next year, you'll want to go SCSI if you own more than one drive.

For mainstream users, however, the new ATA/66 standard is stealing SCSI's thunder by bumping the peak burst speeds of the more popular EIDE interface from 33MB/sec to 66MB/sec, making system manufacturers feel comfortable bypassing SCSI in favor of ATA/66. However, EIDE hard drives will have a hard time sustaining that peak throughput until faster spindle-rotation speeds and higher-density disks come along—and drive manufacturers have traditionally released cream-of-the-crop hard drives with these features in SCSI flavor first. For example, IBM's new data-packed 72GB drive, which boasts 10,000 RPM rotation speeds, is currently

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SCSI-only, because EIDE isn't as forgiving of the high-speed vibrations kicked out by the drive.

While SCSI is God in multi-drive settings, it's more mundane in single-drive configurations. The average user, who uses just a single hard drive and a CD/DVD-ROM drive, won't notice the benefits of SCSI, especially under Windows 98.

If blistering speed is what you're after, SCSI owns the pink slip to tire-squealing throughput. But it takes a serious commitment to go SCSI (don't forget you need SCSI support either on your motherboard or via a PCI card). Since the mainstream doesn't exactly need SCSI power, new systems are EIDE-only and will remain that way for the foreseeable future. The expense of SCSI devices, along with the "perceived difficulties" in upgrading to SCSI drives and adapters, will continue to keep SCSI away from the average OEM desktop in the coming year.

► **SURVIVAL PLAN**: Unless you're a workstation fanatic, stick with an ATA/66 hard drive—just make sure it spins at 7,200rpm and has DMA enabled in the Device Manager.

CPUs: THE SQUIRRELLY

Trust no one. That should be the warning on any CPU roadmap these days. A processor company's projected release dates can fluctuate wildly in either direction, as the winds of chaos whip around them. If a new CPU architecture is fraught with kinks, its launch can be stalled indefinitely. And if Company X decides to accelerate its roadmap, Company Y might have to release its ace-in-the-hole a few months early, in order to stay in the lead.

We interviewed Intel, AMD, analysts, mobo makers, and system OEMs to piece together this roadmap. In other words, this is 2000 as we currently see it; details could change in a heartbeat. Both chip makers were equally reticent to disclose any strategic plans, now that the performance gap between them has closed. There's one thing we're sure of, however: 2000 will see a host of changes in processor technology. Use this intelligence data to determine exactly when you should be pulling your upgrading trigger.

QUARTER 1

750MHz Pentium III - Intel performance desktop CPU on a 0.18-micron Coppermine process. Will probably be the final P-III on the 100MHz bus. Intel should also get the Socket 370 version up to 650MHz.

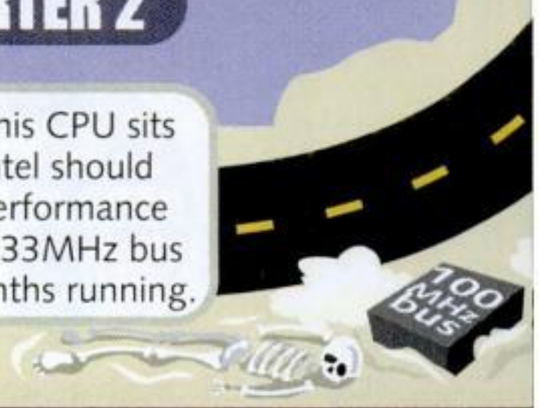
Performance Desktop

600MHz/650MHz Mobile Pentium III- This performance mobile CPU will use a Coppermine core, as well as "Speed Step" technology to increase and decrease speed depending on the power source.

Performance Mobile

QUARTER 2

800MHz Pentium III - Note that this CPU sits on a 133MHz bus. By this time, Intel should have ended its policy of placing performance CPUs on a 100MHz bus when a 133MHz bus was already available for four months running.



700MHz Mobile Pentium III

800MHz Pentium III Xeon - Using the Coppermine core, the 800MHz server/workstation Xeon, codenamed "Cascades," will likely break from the consumer Coppermine by upping L2 cache to 1MB or 2MB—expected to be on-die and full-speed.

Server/Workstation

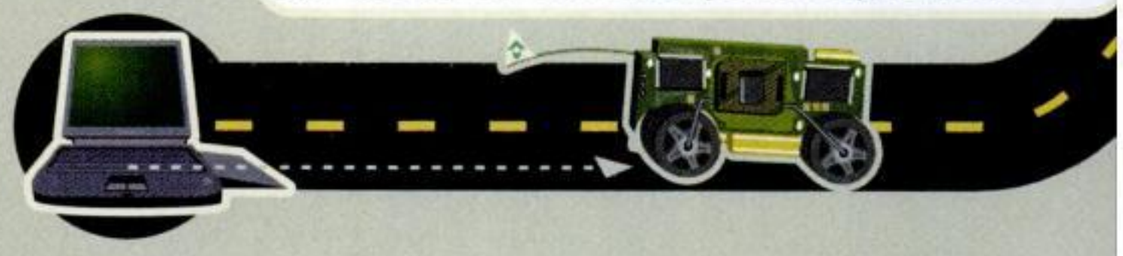
Performance Desktop

800+MHz Athlon - AMD may beat Intel in bringing a 0.18-micron 800MHz CPU to power users. This Slot A proc will continue to feature 512KB of discrete L2 cache. Expect the fastest Athlons to be tied with VIA's new KX133 Pro chipset and feature 4x AGP and PC133.

950MHz Athlon - AMD should introduce two Athlon derivatives in Q2. Based on a 0.18-micron process, the "Thunderbird" core will feature full-speed, on-die cache; start at 950MHz and break past 1GHz; and be offered in Slot A and a secret "Socket A." A second core, codenamed Spitfire, will also be based on 0.18-micron technology, but come only in "Socket A."

Mobile

500MHz K6-2+ K6-III+ - There's still room in the mobile arena for AMDs venerable Socket 7 warriors. The Plus versions will be the same as their desktop equivalents, but with lower power requirements.



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Is this the year ISA will finally breathe its last breath?

Unfortunately, no. Although some PC manufacturers will go ISA-less in 2000, the overriding concern for legacy support means the ISA bus will be around for a number of years. Sure, USB adapters are as plentiful as Latin pop albums right now, but it's unlikely that every PC user will want to incur the upgrading costs of moving entirely to USB components, just to make some sort of political statement. The transition will happen eventually, of course, but it's going to be at least three-to-six years before ISA is wiped out completely. In the meantime, expect to see "closed box" PCs this year, sealed to keep prying hands—and ISA components—out.

So, if ISA is on the way out, will it take the serial, parallel, and PS/2 ports with it? Most definitely—and good riddance, as far as we're concerned. ISA devices require fixed I/Os and IRQs, which are notorious for creating hardware conflict headaches. USB, and

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the upcoming USB 2.0, is primed to replace these aging ports tout de suite, and ensure (with their graceful implementation in the right OS) that you never miss your dumb old plugs. If you've grown attached to your PS/2 mouse and keyboard and you're already suffering from pre-separation anxiety, you'd better get over it—quick—because there are no plans underway to move them to the PCI bus, either.

The one legacy component that might stick around is the 1.44MB floppy drive, but even it stands a slim chance of survival. If for some reason the SuperDisk or another comparable device doesn't shove a stiff boot up its arse, an internal USB connector will replace the floppy disk's traditional ribbon cable, marking an end to ISA's reign once and for all.

► **SURVIVAL PLAN**: Unless you *never* plan to upgrade, stay away from ISA-less, closed-box PCS—you'll still need your legacy ports in 2000.

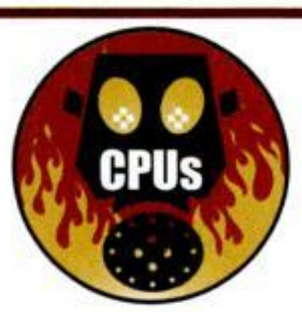
Will memory prices come down soon, or should I just suck it up and buy RAM when I need to?

A host of factors helped push RAM prices up into the stratosphere. Chief among the factors was the Taiwan earthquake, and the push to diversify memory products from known quantities such as SDRAM to unknowns such as Direct RDRAM. Also contributing to the price hike were a host of confusing rumors: that Micron Technology announced it was getting out of the memory business (not true), and that Hitachi planned to halt the production of DRAM (also not true).

From June to September, memory prices more than tripled. Since then, however, prices have stabilized. A single 128MB PC100 DIMM was selling for about $205 in late November. Two months before, the same stick of memory was going for $350. That's the good news. The bad news is that it will probably be a while before 128MB DIMMs drop to $100. When they do, fight the impulse to stock up on memory; previous lessons have taught us that stocking up on gobs of RAM may leave you holding a rock. Remember stocking up on 72-pin EDO SIMMs just after the "glue factory" crisis of the early 90s? When the crisis was over and we moved to 168-pin DIMMs, that $400 investment in EDO RAM turned to dust.

Price fluctuations aside, we must also be concerned with standards. In the new millennium, we'll see VC/PC133 SDRAM duke it out with Direct RDRAM, and PC266 DDR SDRAM take a shot at PC800 Direct RDRAM. What this adds up to is high-risk buying.

► **SURVIVAL PLAN**: With so many competing memory specs on the horizon, a canny survivalist might do best to purchase tons of RAM only when making his next motherboard or full system purchase.



What CPUs will power new PCs?

While 2000's CPU waters will be swift and treacherous, they also promise to take you to places that were unimaginable two years ago. Specifics can be found in the roadmap on page 48, but, according to our deep covers in the industry trenches, you should upgrade according to the following:

Intel will aggressively wind down Slot 1 CPUs in favor of Socket 370. There are also whispers that Intel is playing with a new "Socket 418" that offers compatibility for SMP configurations. Even further down the road, Intel is looking into a 618-pin connector for CPUs. No Intel officials, of course, would confirm nor deny any of this.

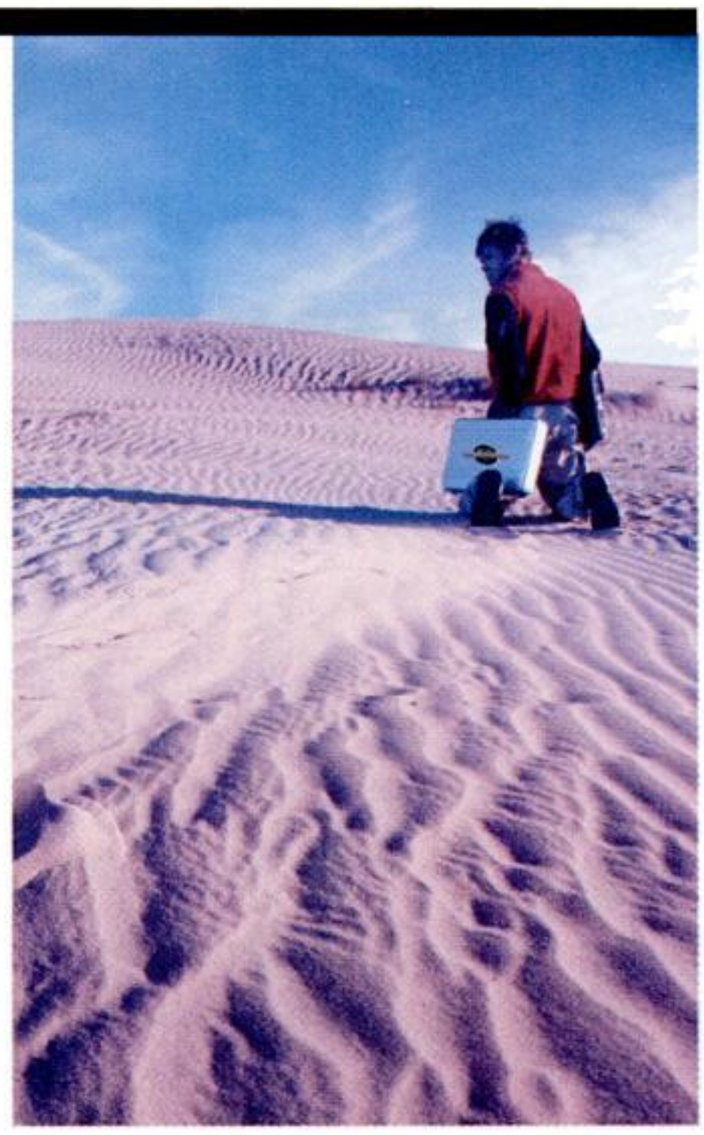
Intel will also continue its trend toward on-die L2 cache in most CPUs. By the second half of 2000, Intel will be heavily pushing its Itanium processor for servers, and we strongly believe Intel will dub its new "Willamette" 32-bit processor "Pentium IV." These plans could be frantically accelerated if Intel senses that it's losing an overall edge to AMD.

After finally stepping from behind Intel's shadow in 1999, AMD will continue to hammer away and push prices down with its Athlon. Expect AMD to introduce a 0.18-micron Athlon with copper interconnects, and move from discrete L2 cache to on-die L2 in 2000. AMD will probably also tackle server configs with 1MB and 2MB L2 cache CPUs in quad or eight-way configurations. And then there's Sledgehammer, AMD's 64-bit processor slated for 2001.

Let's hope some software can tax its power when Sledgehammer arrives.

► **SURVIVAL PLAN**: AMD road warriors should wait until Q2 to see how Thunderbird performs. Intel crusaders should wait until Q3, when Willamette should be cruising down the pike.

"Intel will be heavily pushing its Itanium processors for servers and we strongly believe that the new 'Willamette' 32-bit processor will be dubbed 'Pentium IV.' These plans could be frantically accelerated if Intel senses that it's losing an overall edge to AMD."



With 800 to 1GHz processors available, is overclocking even a relevant practice anymore?

It's not just the "burn, baby burn" attitude that makes overclocking the sport it is today. To understand the overclocking attitude, you have to understand how CPUs are made.

CPUs are produced en masse, then tested to see how fast they'll run. If a CPU runs at 700MHz, it's sold as such. If it doesn't make the 700MHz cut, it's tested at 650MHz. If it passes that test, it's thrown into the 650MHz bin. But because Intel and AMD must sell CPUs at different clock speeds, a CPU that runs fine at 700MHz may very well be sold as a 600MHz or 550MHz. Overclockers know this and want to access that cheap

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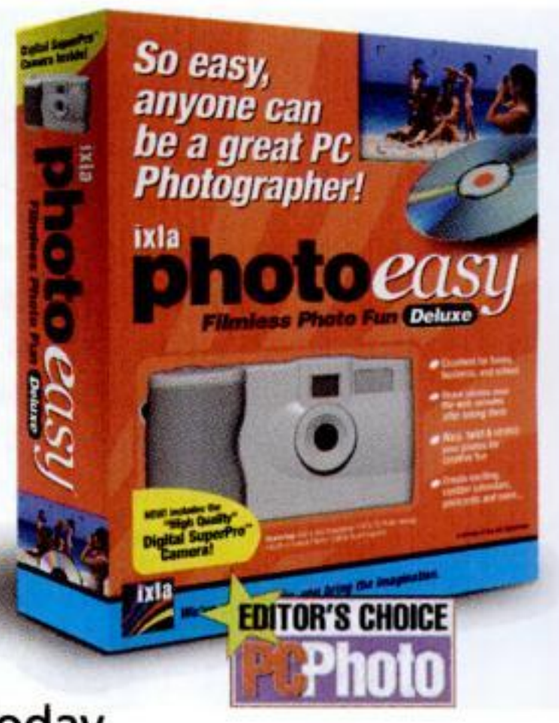

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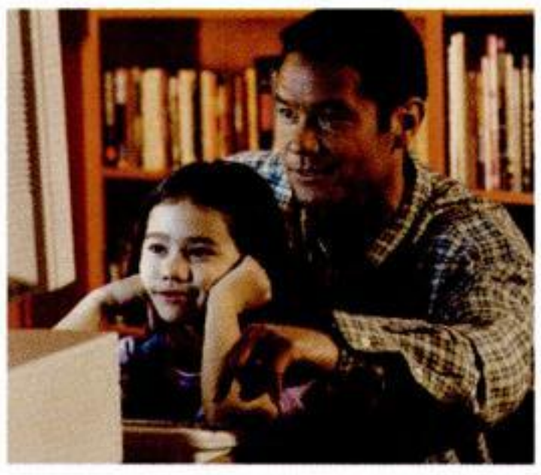

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performance boost. Instead of buying the 800MHz processor for $800, overclockers chose to buy the 600MHz CPU for $200 and run it at 750MHz or so. Is there really a need to run a 1GHz Athlon at any higher speed? No. Is there a need to run a 700MHz Athlon at 1GHz? Yes. You won't see a huge performance increase in your desktop apps from a higher clock, but your 3D rendering times will sure be sweet.

▶ **SURVIVAL PLAN**: Overclocking today's fastest CPUs is foolish—unless you need to warm your hands during a night on the tundra. Make sure you need the power and your CPU can handle the stress.

Do I really need an 800MHz processor if my 233MHz Pentium adequately runs Microsoft Word and Netscape Navigator?

Yes. Although Intel and AMD both face the problem of diminishing returns on performance with their fastest CPUs, you should always spring for the best CPU that you can afford when you buy a new PC.

By picking up a state-of-the-art system, you're not just getting a faster processor; you're getting modern architecture. In the latest PCs, you'll get ATA/66, a 133MHz system bus, and 4x AGP. You'll also get a videocard that probably has as much RAM as your moldy 233MHz system, and a soundcard that can play several audio tracks without choking your entire box. If you keep your computer the way it is now, resist upgrading your apps, and are happy watching *Navigator* render Javascript in slow-motion, then by all means, stick with the hardware you've got. If your time is money, however, pick up that faster machine.

▶ **SURVIVAL PLAN**: Upgrade if you're running anything slower than Pentium III—the apps and OSes of the new millennium are built to suck juice.

When will 64-bit CPUs overtake the desktop? Will there be 64-bit OSes available to run on them?

Don't hold your breath. 64-bit computing for average consumers won't happen in the next five years. The majority of today's PCs run 32-bit CPUs. Intel's 64-bit Itanium CPU, formerly named Merced, is rumored to be much slower than current Pentium IIIs when running 32-bit code.

Of course, AMD is going to take advantage of this by taking a different tack with its 64-bit CPU, codenamed Sledgehammer. Through something called x86-64, AMD will stretch certain instructions, datapaths, and memory-addressing to 64-bit, while remaining x86-compatible. AMD's Sledgehammer should get a performance

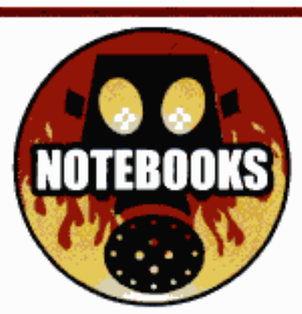
"64-bit computing for average consumers won't happen in the next five years. Intel's 64-bit Itanium CPU, formerly named Merced, is rumored to be much slower than current Pentium III's when running 32-bit code."

leg up over the Itanium by extending the x86 architecture that is so important to Windows and other 32-bit apps.

When Intel introduces its Itanium in late 2000, it will be targeted for server applications where there is a need for large amounts of addressable memory. For example, the 32-bit version of Windows 2000 will address 4GB of RAM. The 64-bit version of Windows 2000 can address a whopping 16TB of RAM. Unless you need more than 4GB of RAM on your desktop machine, you really don't need a 64-bit PC.

Microsoft will time the launch of its 64-bit version of Windows 2000 with the launch of Itanium. Other 64-bit OSes should also be released this year, including Sun's 64-bit Solaris, and Monterey-64, a combined effort of IBM, SCO, and Sequent. Compaq has opted to keep its Tru-64 UNIX OS on Alpha CPUs. None of these are desktop operating systems, of course, but you can be sure that someone's cooking up a new 64-bit version of Linux (with Intel's help) for release sometime this year.

▶ **SURVIVAL PLAN**: For most people, 64-bit CPUs will taste about as good as tumbleweed soup. Stay away.



What kind of Pure PC Power will we see in newer notebooks?

While desktop systems will always be the prime purveyors of PC power, notebooks will be darn powerful in 2000. Boasting new processor innovations from Intel and AMD, notebooks will hit high frequencies—but with a twist. Both Intel and AMD are re-inventing the mobile processor by offering mobile CPUs with speeds and voltage requirements that fluctuate based on a notebook's power source.

Intel's SpeedStep technology, a.k.a. Geyserville, will be integrated into the company's performance-oriented mobile Pentium III line. SpeedStepped mobile Pentium IIIs will be manufactured at 0.18-micron, and run at 600MHz and 650MHz. A mobile 700MHz Pentium III is slated for release sometime in the first half of 2000, with a 750MHz version due out in the latter part of the year.

The SpeedStep technology essentially dictates the machine's power requirements in different modes: 1.6V when running on AC, and 1.35V in battery mode. When the notebook is running off battery power, the processors' clock speed drops down to 500MHz, conserving battery life and power in the process.

AMD has similar technology planned, but isn't currently disclosing any specifics, saying only that it'll be offering 500+MHz versions of their K62+ and K63+ processors in the first half of the year, and 700+MHz mobile Athlons later on. There's no word yet as to what the clock speeds or voltages will drop to during the power-saving mode, but the specs are widely expected to be similar to Intel's.

In the category of "news that doesn't matter," mobile Celerons will top out at 600MHz during the year, but won't include SpeedStep technology. As a result, they'll mostly be relegated to low-end products.

On the video front, watch for notebooks equipped with graphics chipsets that'll put the frag back in your step. Among the top contenders: ATI's RAGE Mobility 128 and S3's Savage/MX, both of which scored an astonishing (at least by notebook standards) 50+ fps in *GLQuake* in pre-alpha benchmarks. In addition, S3 is cooking up other mobile graphics chips based upon the company's SavageExtreme and Savage2000 desktop architectures. But don't expect them until the end of the year, unless Intel deals with the thermal and power consumption hotspots associated with mobile 4x AGP specification.

▶ **SURVIVAL PLAN**: Your new notebook should include 3D acceleration and a variable-speed CPU. Accept nothing less.

Will game consoles, such as Sony's Playstation 2 and Microsoft's rumored X-Box, replace PCs?

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Female Premiums

Age	10 YEAR	15 YEAR	20 YEAR	25 YEAR	30 YEAR
35	$ 280	$ 320	$ 465	$ 580	$ 660
40	$ 310	$ 450	$ 590	$ 770	$ 860
45	$ 560	$ 700	$ 860	$ 1,100	$ 1,320
50	$ 860	$ 1,050	$ 1,295	$ 1,560	$ 1,755
55	$1,280	$ 1,480	$ 2,035	$ 3,130	$ 3,850
60	$1,830	$ 2,250	$ 3,195	$ 8,330	$ 9,420
65	$2,920	$ 3,670	$ 5,855	$15,420	$ 15,420
70	$5,110	$ 6,220	$11,700	$29,340	$ 29,340
75	$8,920	$19,375	$23,100	$41,580	$ 49,680

Male Premiums

Age	10 YEAR	15 YEAR	20 YEAR	25 YEAR	30 YEAR
35	$ 325	$ 400	$ 545	$ 740	$ 885
40	$ 410	$ 550	$ 720	$ 970	$ 1,130
45	$ 740	$ 1,020	$ 1,112	$ 1,650	$ 1,930
50	$ 1,235	$ 1,665	$ 1,677	$ 2,550	$ 3,080
55	$ 1,880	$ 2,550	$ 2,940	$ 6,290	$ 9,095
60	$ 2,985	$ 3,830	$ 5,100	$14,340	$14,340
65	$ 5,155	$ 6,470	$ 9,885	$20,820	$20,820
70	$ 9,335	$11,715	$19,260	$34,980	$34,980
75	$17,420	$29,665	$38,220	$52,860	$60,120

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PlayStation 2 has specs to die for, but at the end of the day, it's like any other console: a closed system, with a beginning and an end. It's essentially a terrific 3D chip that's doomed for eternity to display at 752x480 TV resolution. The PC's expandability will always put it ahead of any console in terms of next-gen features and 3D performance. Your PC can grow with technology; a console is a locked box.

Sony's PS2 may be a threat to companies trying to position low-end DVD players, since for a few dollars more, you get a nice game console with optical digital audio. If you can track down a Dolby Digital receiver with optical digital in, you'll get the full 5.1 surround-sound experience. But the current PS2 specs don't call for an IR interface, and what's a DVD player without a robust remote?

And what about all of PS2's expansion ports: PCMCIA, USB, and I.Link (a.k.a. FireWire)? Sony is promising all sorts of keen broadband and multimedia expansion in 2001, right? Remember that "reserved for future expansion" is almost invariably synonymous with "sucker bet." If you don't believe us, look at all the unpopulated connectors at the back of the original Playstation—nothing in those serial and parallel ports, is there?

Then there's Microsoft's as-yet-unannounced X-Box—is she or isn't she? If she is, according to this week's rumor mill she's a sealed-box PC that runs on an Athlon, a GeForce, and a hard drive, thus violating console rule Number One: "Thou shalt minimize moving parts." Building and supporting hardware isn't Microsoft's long suit, so some believe X-Box will essentially be a "WebTV Ultra" that plays really keen games. Uh, thrilling.

► **SURVIVAL PLAN**: Replace your PC with a TV-tethered console? Who says you'll even have television in the new millennium? Stick with your PC.

Will Linux offer enough hardware and gaming support to justify dumping Windows?

While Linux has made incredible gains in supporting the latest and greatest peripherals and games, it still doesn't hold a candle to the everything-in-the-box support that comes with Windows 98. However, with Microsoft all but hung-out-to-dry in the DOJ's antitrust case, now might be a good time to squeegee Windows off your desktop and check out alternative OSes.

The fact that Linux can be had for free has certainly propelled it into mainstream consciousness, but its reputation for being a bitch to install and impossible to use—and the fact that there's virtually no commercial software available for it—hasn't done much to convince folks to take the plunge. Without better hardware and software support, Linux will never amount to anything more than a niche OS used by tech-heads with a degree from Geek U.

Unfortunately, Linux's true support level is extremely hard to peg. Though it's true that strides in Linux hardware and software support have reached an all-time high, we'd argue that until you can do everything under Linux that you can do with Windows, it's not quite ready for primetime. Unlike Windows, there's no

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release schedule for new versions of Linux, since it gets updated daily by users around the world. There's also the big issue of hardware compatibility. USB support, for example, is spotty at best under Linux. Mice and keyboards work fine; scanners and printers only sporadically. FireWire support is non-existent. 3D support exists primarily because of the Xfree86 project, a freely re-distributable version of the X-Window System that provides integrated support for myriad PC components, including graphics cards. Software support is anemic, and games, the staple of any PC library, are limited to the handful that are put out by Loki Entertainment and Activision. Of course, you can always switch to native Linux applications, many of which rival their Windows counterparts in features and usability.

The ultimate question is, Should users be expected to spend countless hours tweaking, twiddling, and tinkering with an OS just to make their PC work? Oh wait, we already do that—with Windows.

▶ **SURVIVAL PLAN**: The fastest way to accelerate overall Linux support is to use Linux, and contribute to its development. It's free, so install it as a second OS.

I'm using Windows 98, but I hear Microsoft is releasing a new version this year. Is it worth the upgrade?

Whether you should upgrade to Windows Millennium, which is due on store shelves by the end of 2000, depends on what kind of user you are. If you're a power user with a burly PC, consider going directly to the NT-based Windows 2000. For most of us, however, Millennium will supply just enough innovation to send us trotting once again down the upgrade path. Besides making a quick buck for Microsoft, Millennium's sole reason for existence is to make Windows "just work." It's aimed squarely at home users who want their computing experience simplified—which describes most people. But for those of us who can tell a Device Manager from a hole in the ground, Microsoft's intrusiveness in the name of "help" will likely seem more bothersome than anything else.

The biggest improvements in Millennium will come from finally purging real mode support from the OS. Without the legacy support baggage, Windows should boot up faster and run smoother than ever before.

Jason Compton, Bryan Del Rizzo, Sean Downey, Kenn Durrence, Josh Norem, Scott Tarr, and Gordon Mah Ung contributed to this article.

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"Given the choice between DSL and cable broadband services, we'd choose DSL. It offers a fast pipeline to the Internet; it's available from multiple providers, and you won't generally have to worry about a neighborhood bottleneck."

Another lofty goal for Millennium is the planned integration of all help functions into a one-stop help program. In the new help system, vendor-specific info for individual PCs—as well as upgrade component info—will be all available and searchable from one place. To accomplish this, Microsoft plans to allow vendors to integrate their help forms directly into Windows, though it's questionable how successful the final result will be. Of course, if you majorly screw up your PC to the point where nothing seems to help, you can always use Millennium's global system undo feature, which rolls your OS back to the last known good configuration.

Plans are in the works to make Millennium capable of recognizing plug-and-play "smart devices," such as the slew of Internet appliances likely to be announced in 2000. Depending on how you look at it, there will also be improvements in the gaming department, mainly in the form of the Windows Game Manager. This feature first made headlines as a "violent content filter" that parents can use to set the amount of time games can be played on the computer, and to control which users can access which games. It will do much more, though, such as keeping track of games you haven't played in awhile and selectively uninstalling portions of unused games, allowing new ones to fit on your hard drive.

For inexperienced users, these additions will be a godsend. But for more experienced users who prefer to troubleshoot and configure components on their own, we suggest sticking with Windows 98 until the NT kernel is successfully integrated into a consumer-level OS.

► **SURVIVAL PLAN**: If you have no intention whatsoever of trotting down the NT road, upgrading from Window 98 to Millennium makes good sense—*if* they set the price right and the OS's performance benefits prove attractive.

Should I upgrade to Windows 2000?

If you're a power user running Windows NT 4.0 with Service Pack 5, an upgrade to Windows 2000 Professional is well worth it. It blends the NT 5.0 kernel with the best features of Windows 98: plug-and-play, USB, DirectX 7.0 (including Direct3D), and a host of usability tools that will move your PC beyond those funky old NT 4.0 configuration screens and into the 21st Century (Check out our preview on page 20).

If you're running Windows 98, you simply won't benefit from upgrading as much as an NT user will. You've already got plug-and-play support, decent USB support, and DirectX. The NT kernel is more stable and it multitasks better than Windows 98, but if you upgrade, you'll have to find where Microsoft buried the interface feature you want and address the possibility that your apps and games aren't compatible.

► **SURVIVAL PLAN**: Windows NT users: Proceed immediately. Win98 users: Proceed with caution.

DSL or Cable in 2000?

Given the choice between DSL and cable broadband services, we'd choose DSL (DirecPC satellite isn't even a contender, unless you're stuck living in the middle of a wheat field). It offers a fast pipeline to the Internet; it's available from multiple providers, compared to cable's scant few; and you won't generally have to worry about a bottleneck occurring when too many people go online simultaneously.

Unfortunately, the majority of homes across North America can barely get access to one broadband technology, let alone two. And despite the fact that we prefer DSL, it's a known fact that cable will continue to outpace DSL deployment by a wide margin.

If you can't afford the $50-plus per-month service charge for full-rate DSL service, consider G.Lite, a lower-cost, lower-bandwidth alternative. Unlike regular DSL, G.Lite can usually operate without the installation of special filters or splitters, and still provide 1.5Mbps downstream and 384Kbps upstream of bandwidth. It's expected that G.Lite will be offered for approximately $30 to $40 per month, but there's no guarantee that the price will dip any lower than current offerings, especially since many providers are throttling back ADSL packages to hit lower price points.

If DSL isn't yet offered in your area, or if your house is too far away from your local switching station (DSL's biggest caveat), cable can still be a great deal. In fact, AT&T is rolling out a new combo package, consisting of multiple phone lines—yes, phone lines—digital cable TV, and cable broadband, all for under $100 per month.

► **SURVIVAL PLAN**: Take whatever broadband you can get—but go with DSL if you have the option.

Will MP3s survive?

MP3s are the current king of the music mountain, but if the Recording Industry Association of America and other technology companies have their way, MP3s will give way to new formats that also protect the interests and copyrights of artists and their big-money backers. Microsoft and AT&T, in fact, are pushing forth their own technologies that may have what it takes to put MP3s six feet under.

The two biggest formats vying for your attention are AT&T's a2b and Microsoft's Windows Media Audio (WMA), both of which will include encryption standards that adhere to the RIAA's Secure Digital Music Initiative (SDMI), making it more difficult to send and receive illegal files.

Both a2b and WMA will provide up to 20:1 compression—better than MP3's lesser 10:1 ratio—resulting in smaller and quicker downloads that still retain CD-quality sound. Also, both formats can be streamed through media players, eliminating the need to actually download files and consume hard drive space. But the various encryption possibilities, such as requiring users who want to play a downloaded music file to have a separate license containing a key, will make sharing music more difficult. Specific registry information may have to be modified in order to play a single file; if no key is found, you'll be re-directed to a license registration page, where you may have to cough up personal information—or money.

With the sheer amount of music available on the Net, both formats should thrive in the coming years, but whether MP3 will survive the juggernaut remains to be seen.

► **SURVIVAL PLAN**: Some type of digital music format will kill audio CDs—but today's portable MP3 players will become as quaint as "record players" as the millennium wears on. ✹

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CAN YOU DIG INTEL'S NEW SUPERFAST PENTIUM IIIs?

Oh, what a new manufacturing process can do for a fading CPU architecture. Intel has breathed new life into its P6 family by ditching 1999's Katmai core in favor of new Coppermine technology. Here's the deets on the latest version of the Pentium III, and reviews of two screaming new systems. It's all about faster cache and clock speeds.

What's the difference between Coppermine and Katmai P-IIIs? Both Coppermine and Katmai P-IIIs employ the same P6 core architecture that was originally developed for the Pentium Pro, and later used for the Pentium II and Celeron families. Likewise, both versions of the P-III employ the eight new registers and 70 SSE instructions that turbocharge multimedia and gaming applications with SIMD execution.

But Coppermine makes the leap to a new 0.18-micron process technology that's significantly more efficient than the 0.25-micron technology of the third-generation Katmai—and a more efficient process means you can ratchet up those core CPU clock speeds without worrying about excessive heat. (Deschutes, Intel's second-gen process technology, also used a 0.25-micron process, but it lacked SSE instructions. Klamath, the technology that launched the P-II, used a 0.35-micron process.)

The new Coppermine process also includes 256K of full-speed, on-die L2 cache. Combine faster cache with faster core clock speeds and you have a new CPU family that could give the AMD Athlon a case of night sweats.

Most folks won't see any physical difference between the Coppermine and Katmai P-IIIs, as the Coppermine's most popular package will be the familiar, oblong Single Edge Contact Connector 2 cartridge. A slower Socket 370 version will also be available, for budget desktops.

What's on-die cache? Earlier generations of the Pentium II/III use "discrete" L2 cache—that is, L2 cache located on a separate chip near the processor die (the two pieces of silicon sit on a common daughtercard, which is then stuffed inside the now-familiar black plastic cartridge).

If you have a 500MHz Pentium III, the discrete L2 cache runs "half-speed" at 250MHz. But when Intel fabbed down to a more efficient 0.18-micron process, it suddenly found itself with more circuit paths to play with. The dividends were parlayed into dedicated L2 cache circuitry etched right on the CPU die.

On a 700MHz "E" Pentium III, the cache runs at a blazing 700MHz. Conventional wisdom says 256K of *full*-speed L2 cache offers better performance than 512K of *half*-speed L2 cache—and test results bear this out. Just consider how successful the second-gen Celeron CPUs have been with their 128K of full-speed L2 cache. And, of course, we should also mention that running L2 cache at full-speed fosters much easier overclocking.

Intel will use the "E" nomenclature to identify Coppermine CPUs, and "EB" to identify Coppermine CPUs that run on a 133MHz system bus. The fastest Intel desktop CPU available at the Coppermine launch is the 733EB Pentium III.

How small is 0.18-micron? It's so small, an angel could barely put a delicate pinky toe on it. A 0.18-micron structure is 1/500th the thickness of a human hair. It's smaller than bacteria, and smaller than a wavelength of visible light. The finer the manufacturing process, the lower the power requirements, the lower the heat generated, and the lower the cost.

A Coppermine die measures a scant 106 square millimeters. Even with its on-die cache, the Coppermine is still 22 square millimeters smaller than a 0.25-micron Katmai, and a whopping 78 square millimeters smaller than a 0.25-micron Athlon.

What's Advanced Transfer Cache and Advanced System Buffering? In addition to etching cache onto the Coppermine core, Intel widened the CPU-to-L2 data bus from 64 bits to a whopping 256 bits. That's the equivalent of quadrupling the lanes on

BY GORDON UNG

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CONTINUED ON PAGE 63

RMINE

SPECS

Processor Pentium III/Xeon Coppermine
Type P6 core with Advanced Transfer Cache and Advanced System Buffering
Interfaces Slot 1, Slot 2, Socket 370, and various mobile interfaces
Fab Process 0.18-micron
Die Size 106mm^2
Transistor Count 28 million
Voltage Requirement 1.65V (for desktops)
Cache 32K full-speed, on-die L1; 256K full-speed, on-die L2
Compatible core-logic chipsets BX, 810e, 820 (desktop); GX, 840 (server); MX, BX (mobile)
Speeds available at launch 533/133, 600/100, 600/133, 650/100, 667/133, 700/100, 733/133 (desktops); 500/100, 550/100 (Socket 370); 600/100, 667/133, 733/133 (servers); 400/100, 450/100, 500/100 (mobile)
Prices Up to $776 (for 733/133 Pentium III, Intel's fastest desktop CPU)

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Dell Dimension T700R

PENULTIMATE INTEL POWER

After suffering the disastrous setback in November with the delay of its Camino chipset-based system, Dell strikes back with the fastest CPU/chipset combo Intel could muster up. Unfortunately, with the Camino systems stuck in dry dock, Dell is relying on an aging chipset to power its flagship PC.

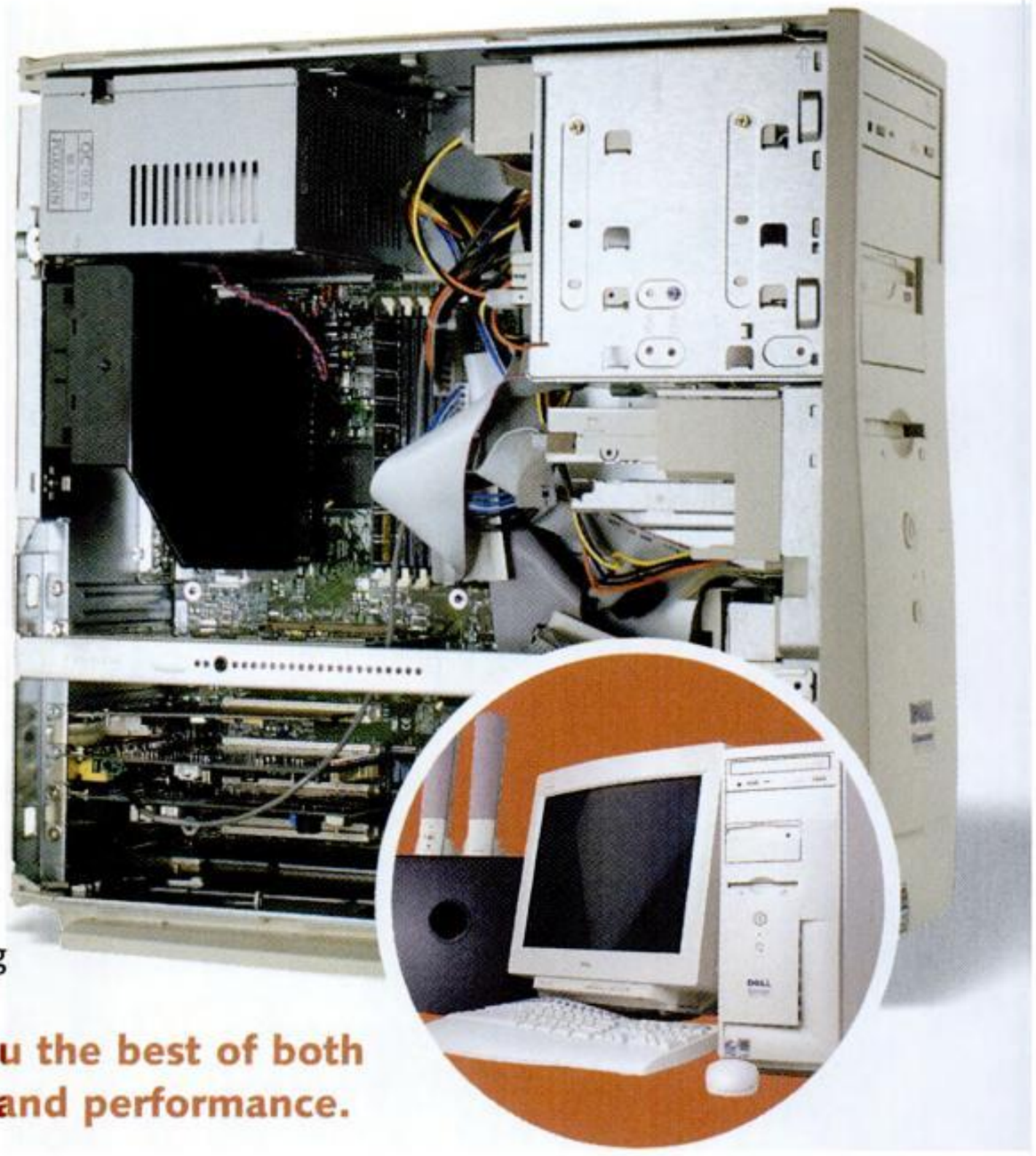
So, what happens when you partner a 700MHz Coppermine with the "mature" BX chipset? Answer: Surprisingly good results. The largest leap in performance appears in Windows applications, which don't seem to require the faster system bus and Direct RDRAM support that the dry-docked Camino chipset offers. The 700MHz Coppermine is nearly 20% faster than a 600MHz P-III on the BX chipset.

PLUSES
- Coppermine CPU
- GeForce 256 videocard
- Speedracer keyboard
- RIO 500

MINUSES
- Lacks next-gen features such as 4x AGP, 133MHz system bus, and Direct RDRAM support

In the floating-point-intensive *Inspire* 3D rendering test, the T700R performed about 21% faster than Dell's 600MHz Katmai machine. In gaming, the Coppermine P-III doesn't provide the same big boost offered by previous CPU revisions, but it does offer a bump. In *Expendable*, our Direct3D test, the new P-III pulled four more frames than a 600MHz P-III equipped with the same graphics card. The T700R also yanked three more frames in *Quake II*.

The T700R is about more than the CPU, though, and that's a good thing, since the Micron system on page 61 comes with a 733MHz CPU on a 133MHz bus (care of a VIA chipset). Dell outfits its classic ATX case with a host of niceties, including Microsoft's "Speed Racer" keyboard with Internet hot keys and a built-in USB hub. Dell also includes Creative's Live! Value card with a digital SPDIF port. More impressive is the Harmon/Kardon subwoofer—it's so fat, we thought it was an ottoman. Alas, while plenty loud, the sub's circuitry prevents you from lowering your sperm count with low-frequency effects. Bugger!



The T700 gives you the best of both worlds: reliability and performance.

On the video front, Dell is going with a custom-built nVidia GeForce 256 card, a wise choice for anyone looking to stay on the high-end of the power curve in 2000. Bucking the current trend, however, Dell equips its new box with a 100MB Zip drive instead of a CD-RW. While we've found that a legacy Zip drive can be more versatile than a CD-RW drive, we have to say we're disappointed by the omission.

Bundled with the *WinDVD* software, the T700R doubles nicely as a home entertainment system. We'd have preferred Dolby Digital 5.1 support in a hardware decoder, as well as a 5.1 positional speaker system, but those options can be custom-ordered. Dell also bribes you with a Diamond RIO 500, the best MP3 player on the market, and a Microsoft game pad. You can also opt for a 10Mbps phoneline networking kit and G.Lite modem.

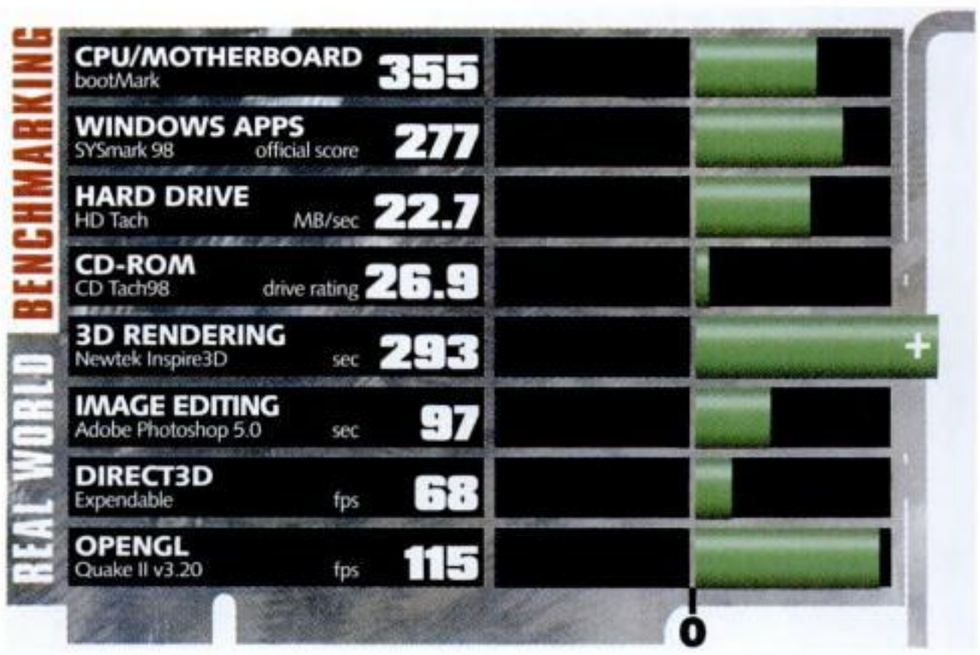
Is it all enough? For those who are dead set on sticking with the reliable and proven Intel BX chipset, the T700R may be your best choice.

—Gordon Mah Ung

UNDER THE HOOD

THE BRAINS	
CPU	700MHz Intel Pentium III "E"
L2 Cache	256KB on-die
RAM	128MB PC100
Moboard	Dell-branded Intel "Seattle" 440BX
Drive Bays	Two 5.25-inch, four 3.5-inch
I/O Ports	Two USB, two serial, one parallel, one gameport
DISPLAY	
Video Card	Dell-branded nVidia GeForce 256 32MB
Monitor	Dell-branded P991 19-inch Trinitron
Refresh@ Max Res	72Hz@1600x1200
STORAGE	
EIDE	ATA/33
Hard Drive	Maxtor ATA/66, 7200RPM with 2MB cache
DVD-ROM	Hitachi GD-5000 8x DVD
Removable	1.44MB floppy, 100MB Zip
Fax/Modem	G.Lite and v.90 modem
SOUND	
Sound	Creative Labs Sound Blaster Live!
Speakers	Altec Lansing ADA880 five-piece
OTHER	
10Mbps phoneline networking support	
THE BUNDLE	
Microsoft *Works Suite 2000*, Windows 98 SE, Diamond RIO 500 64MB	

BOOT 0:59 DOWN 0:02



MAXIMUM PC VERDICT

Price $2,713 ($3,412 with 19-inch monitor, Rio and gamepad)
Company Dell
Phone 800.388.8542
URL www.dell.com

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PHOTOGRAPHY BY AARON LAUER

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MICRON MILLENNIA MAX

FASTEST INTEL PC WE'VE SEEN

MAXIMUM PC KICK-ASS! product

If you want your Intel silicon served with 4x AGP, ATA/66 support, and VC133 memory, Micron's Millennia Max is the dish to order. With healthy portions of next year's technology, the Max is currently the only name-brand performance PC that can run Intel's fastest CPU on a 133MHz system bus. You can thank VIA's Apollo Pro 133 chipset for taking Micron to a memory speed that Intel currently can't muster.

The Millennia Max is the fastest Intel desktop we've ever seen. While some might think Intel has ceded bragging rights to AMD's Athlon, we think the 733MHz Millennia puts Intel back in the game. In fact, the Millennia Max beat the snot out of our benchmarks and sent them home screaming for mommy.

The Max downright shattered our *Inspire* 3D rendering test, shaving 90 seconds from the score turned in by a 600MHz Millennia Max. That's a phenomenal 33% increase in performance. If you're a 3D artist and *Inspire* is your tool, bumping up to a 733MHz Millennia could literally save you hours in rendering time. In the bootMark—which measures overall integer, chipset, and memory performance—the Max upped the record to 385, blowing away the 700MHz Athlon Alienware by almost 50 points.

With this kind of performance, we expected to see the Millennia Max usurp the Alienware in the *SYSmark* benchmark, which measures a system's speed in common Windows apps. Alas, the Max fell short of the Athlon-based Alienware's 294, hitting just 280—although that score is the fastest we've seen from Intel silicon. Micron PC engineers claim that a near duplicate of the machine they sent us hits in the low 290s, but we couldn't reproduce that performance in the Lab.

With its Creative Annihilator GeForce card, the Max turned in the fastest *Expendable* scores yet, and a very respectable 113fps in *Quake II*. Still, neither score shows major improvement over the 700MHz Dell and its slower 100MHz bus. Chalk it up to aging benchmarks and the überfast GeForce card. We may not see performance benefits from 4x AGP and a 133MHz bus until the industry releases games—and their attendant benchmarks—that really require more bandwidth.

The Millennia doesn't skimp on components. Tying a massive 34.5GB IBM DeskStar to the chipset's ATA/66 interface, Micron has ensured that you'll have a hard time finding ways to fill the machine's storage space.

Overall, the Millennia is a sweet package that offers nearly every top-notch feature available today. About the only thing that would make it sweeter is an Athlon.

—Gordon Mah Ung

The Millennia Max holds the landspeed records for Intel-powered boxes.

PLUSES

- 733MHz Coppermine
- GeForce 256 videocard
- Creative DXR3 DVD Decoder
- Mobo supports future "Flip-Chip" CPUs
- Beautiful case

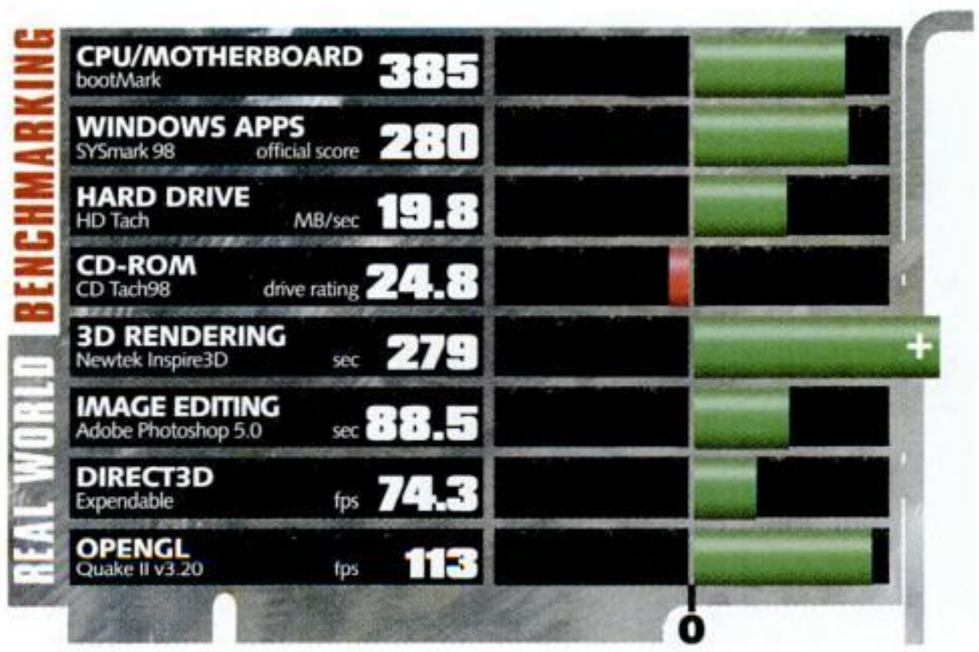
MINUSES

- Optional monitor is slightly bulbous

UNDER THE HOOD

THE BRAINS	
CPU	733MHz Intel Pentium III "EB"
L2 Cache	256KB on-die
RAM	128MB VC133 SDRAM
Moboard	Tyan Trinity 400 with VIA Apollo Pro 133 chipset
Drive Bays	Two 5.25-inch, four 3.5-inch
I/O Ports	Two USB, two serial, one parallel, one gameport
DISPLAY	
Video Card	Creative Labs Annihilator
Monitor	Micron 21-inch
Refresh@ Max Res	85Hz@1600x1200
STORAGE	
EIDE	ATA/66
Hard Drive	34.5GB IBM Deskstar, UDMA/66, 7200rpm
CD/DVD	NEC 8x DV-5500A DVD-ROM, Sony CRX100E CD-RW
Removable	1.44MB floppy
Fax/Modem	None
SOUND	
Sound	Aureal Vortex SQ2500
Speakers	Cambridge SoundWorks Desktop Theater
THE BUNDLE	
Microsoft Office 2000 Small Business I Windows 98 SE I Adaptec *EasyCD Creator 3.5*	

BOOT 0:59 DOWN 0:04



MAXIMUM PC VERDICT

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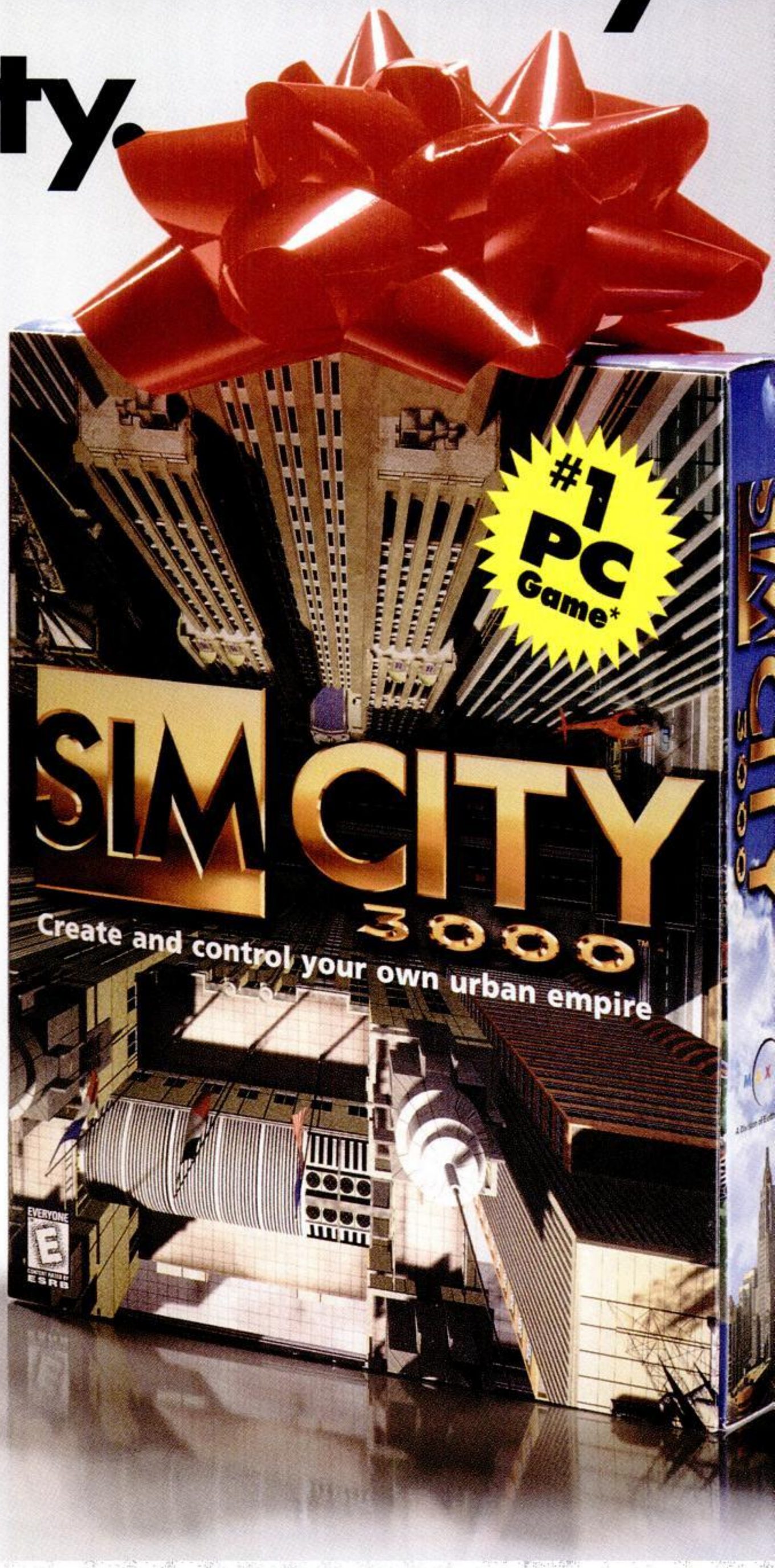

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a busy freeway. Intel also added several more buffers, to smooth the data flow in and out of the processor. Intel says the changes add up to a 4x reduction in latency, and a sustained bandwidth of 1GB/sec on a 133MHz system bus.

Is there copper in Coppermine? No, there's no copper in them thar hills; Intel codenamed the newest P-III after the Coppermine river located in Oregon. The chip continues to use aluminum interconnect technology, which Intel has advanced to a six-layer process. Chip companies expect jumps in performance when they switch to copper interconnects, thanks to copper's superior conductivity properties.

Hasn't Intel already hit 0.18-micron in other CPUs? In June, Intel introduced a 400MHz Pentium II for mobile machines based on 0.18-micron technology. The Coppermine P-III mobile will include SSE instructions and advanced cache and buffer techniques, making it 20% to 25% faster than the P-II 400 mobile.

What speeds can the new process technology comfortably reach? Coppermine makes its debut at a lightning-fast 733MHz. Intel expects to push it to 800MHz by early 2000 and past that by mid-year. Coppermine may have the ability to hit 1GHz, but will probably be eclipsed by the IA-32 Willamette processor. See our CPU roadmap on page 48.

What kind of motherboard support does Coppermine need? The good news is that many modern muddas will support, or already support, Coppermine CPUs; you may only need a BIOS patch. In an ideal world, Intel would have you run Coppermine with its 820 chipset and Direct RDRAM. Intel's official chipset list, however, includes BX, 810e, and 820.

For workstations, the 840 chipset supports Slot 1 and Slot 2 Coppermines. VIA Technologies' Apollo Pro 133 will also support Coppermine. But, be warned: Due to the low 1.65 voltage of Coppermine CPUs, some motherboards simply won't support the new process. You may also be foiled by a lack of multipliers. To hit 700MHz on a 100MHz BX board, you'll need a 7x multiplier. If your board's BIOS doesn't support that multiplier, you're SOL. Before you plunk down your dollars, check your motherboard manufacturer's web page for compatibility.

Why are we moving back to sockets? Intel says the rationale behind packaging the Coppermine in a Socket 370 "Flip-Chip Pin Grid Array" (FP-PGA) is to feed the trend towards small, form-factor PC cases. Initial FP-PGA speeds will be 500MHz and 550MHz.

Of course, it's also cheaper to manufacture a CPU that doesn't require its own PCB (in the form of a daughtercard) and plastic shell. Since Intel no longer needs the PCB real estate of the SECC cartridge for discrete L2 cache, Slot Connector 242 (as Slot 1 is sometimes fancifully called) is expected to fade away by 2001.

Can the Coppermine be overclocked? Yes and no. Because of its full-speed cache and lower voltage and thermal envelope, Coppermine could be a sweetheart for overclockers. Intel, however, will again implement its clock-locking techniques in hopes of preventing tomfoolery with its chips.

How does Coppermine compare to Katmai Pentium IIIs and the Athlon? If you're out to buy the fastest Intel box on the market, you'll definitely want a Coppermine system. Looking at our benchmarks, it's clear that Coppermine smokes Katmai in every performance test. Is it worth upgrading? Only if the applications you run need a serious shot in the arm. Faster cache and a boost in clock speed can make a big difference in such activities as 3D rendering, where every second counts. But if you're a 3D gamer, you may only need a GeForce card to play next year's hottest games.

Although the 733MHz Coppermine is the best response Intel has had to AMD's Athlon, Athlon is still king of overall performance. The performance gap that made the Pentium III seem an utter weakling two months ago has now closed quite a bit. But AMD has its own 0.18-micron technology on deck, with real copper inside.

COPPERMINE SQUARES OFF

Maximum PC readers always want to know how a new CPU design compares to other processors at the same clock speed. But what do you do when Intel won't send you a 600/100 Coppermine to go up against a 600/100 Katmai? You underclock the Copper. Which is what we did, after getting Intel's assurance that it would be OK to slow down a 700/100 to 600/100 for the sake of testing.

We compared Coppermine, Katmai, and AMD Athlon CPUs at 600MHz. All were equipped with 128MB of PC100 SDRAM, 7,200 EIDE hard drives, and identical Diamond V770 Ultra cards running nVidia's 2.08 Detonator drivers.

To showcase Coppermine at its fastest speeds, we also ran comparative tests with the systems reviewed on pages 60 and 61. These bad boys were pitted against last month's 700MHz Athlon-based Alienware system. All of these machines were running GeForce 256 cards and 7,200 RPM EIDE drives. The Micron was the sole machine with 4x AGP, VC133 SDRAM, and a 133MHz system bus. We removed 128MB of the Alienware's 256MB of memory for the sake of fairness.

The benchmark results speak for themselves. The *SYSmark* benchmarks—the first eight tests in the list below—were drawn from BAPCO's famous real-world testing suite. These are timed scores, represented by minutes and seconds; lower times are better. The *Inspire* and *Photoshop 5.2* scores are part of *Maximum PC*'s testing suite. They're also timed; lower times are better. *Quake II Crusher* is measured in framerates; higher is better. The CPU Mark and bootMark tests are synthetic benchmarks; higher scores are better.

We've colored red the best scores for each test run. To learn more about our benchmarking process, visit www.maximumpc.com.

COMPANY	INTEL	INTEL	AMD	ALIENWARE	DELL XPS T700R	MICRON MILLENNIA733
CPU	600 Cu	600B Katmai	600 Athlon	700 Athlon	700 ECu	733 EBCu
Bryce 2	100	108	86	76	89	88
CorelDraw 8	158	174	147	116	138	135
Excel 97	79	89	85	83	73	75
Omnipage 8	86	88	75	71	73	73
Paradox 8	44	48	52	43	44	48
Power Point 97	54	57	53	69	56	51
Premiere 4.2	40	42	36	32	34	32
Word 97	81	85	75	71	75	74
Inspire	334	363	397	354	293	281
Photoshop 5.2	99	124	102	91	97	88
Quake II Crusher*	65	62	67	89	88	88
3Dmark CPU Mark	9,235	9,118	11,089	11,276	10,566	10,978
bootMark	313	279	289	337	355	385

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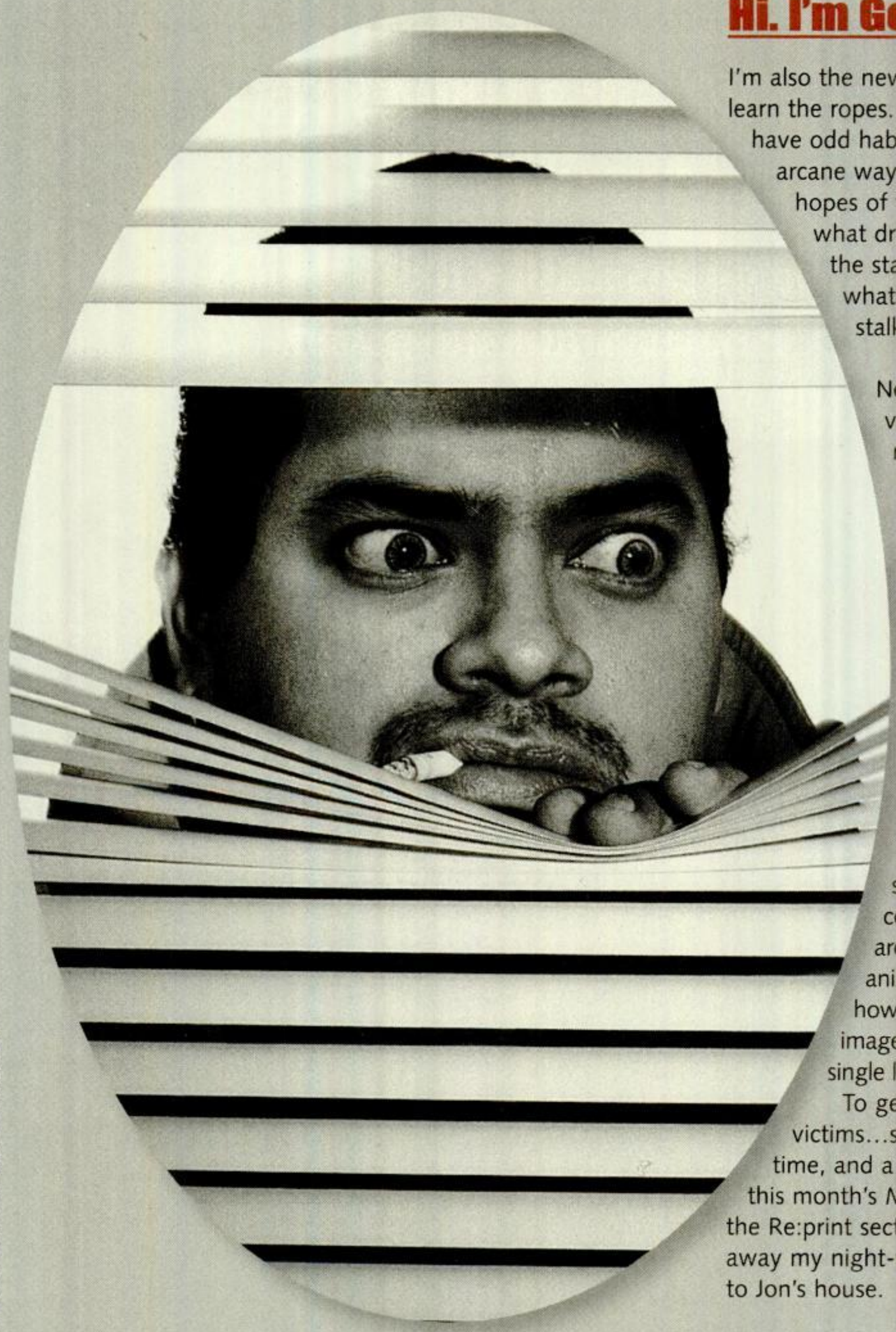
Building Web sites With DREAMWEAVER 2

The New Guy goes WYSIWYG to expose his many "layers" of psychopathology

by Geoffrey Visgilio



PHOTOGRAPHY BY JACK HUTCHESON

Hi. I'm Geoff, and I'm a stalker.

I'm also the new guy at *Maximum PC*, and I've been trying to learn the ropes. But these magazine people are whacked! They have odd habits and speak in riddles. So, to better learn their arcane ways, I decided to delve deep into their minds, in hopes of finding out what the editors are *really* like, and what drives their PC passions. My plan was to follow the staff around, catch them off-guard, and see what I could learn by way of some old-fashioned, stalker-style surveillance.

My co-workers had mixed feelings about "The New Guy" darting around the office and snapping voyeur shots with a digital camera. In the beginning, most of them didn't seem to mind. But after awhile, I began to see more magic middle fingers than friendly smiles. In the end, they took away my camera and locked me in the Lab—but not before deciding that my little spy missions shouldn't go to waste. So, as part of my community service requirement, I'm here to instruct you on how to build your very own web page, so you can be a stalker, too.

No, this is not another tired "how to build a web page" article. Working with *Dreamweaver 2*, a great WYSIWYG editor that received a 9 verdict in our March 1999 issue, we'll be using layers, the next step in HTML evolution. They're a great substitute for tables, and they allow you to drop content anywhere on a web page, then move it around at will. Layers can contain text, graphics, animations, and even other layers. I'll also show you how to create easy mouseovers, and how to insert images and links onto a page—all without touching a single line of code.

To get started, you'll need pictures of your victims...sorry, I mean pictures of your *subjects*, a little time, and a copy of *Dreamweaver 2*, which is available on this month's Maximum CD and on **www.maximumpc.com** in the Re:print section. Go ahead and pull up a chair, while I stash away my night-vision goggles in preparation for tonight's visit to Jon's house.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

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Know Your Interface

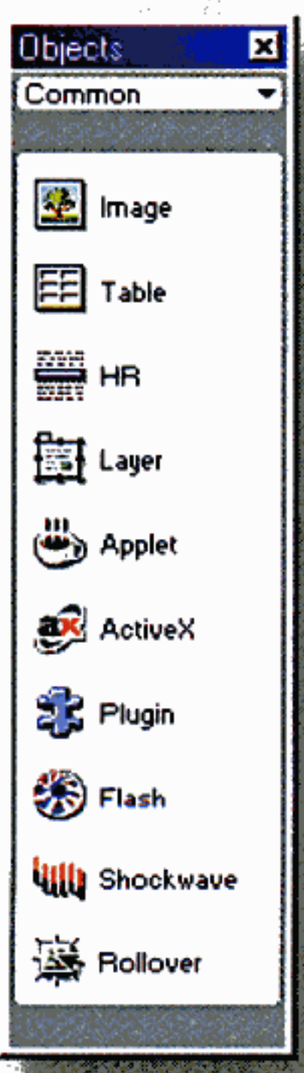
Let's walk through the Dreamweaver 2 tool palettes, which are the basic palettes that pop up whenever you launch the application. FYI. If sometime later you want to experiment with the more advanced palettes, which are typically used to build complex web sites for businesses, you can display them through the Windows section of the menu bar.

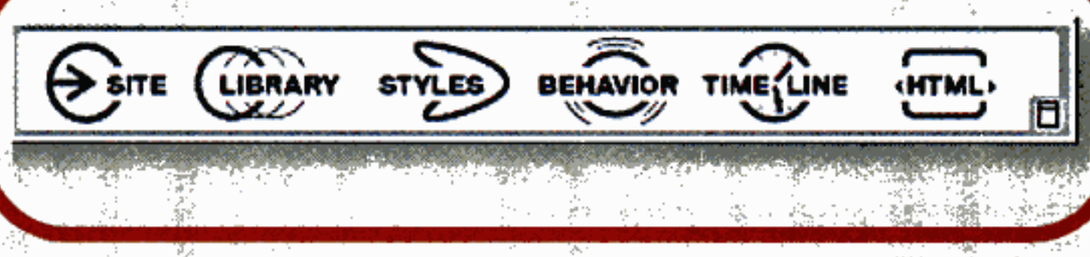
Objects Palette This palette features tools you will use to insert elements directly into your page. It can display four different menus: Common (the tools seen here), Forms (e.g., radio buttons), Head (e.g., META tags), and Invisibles (e.g., anchors).

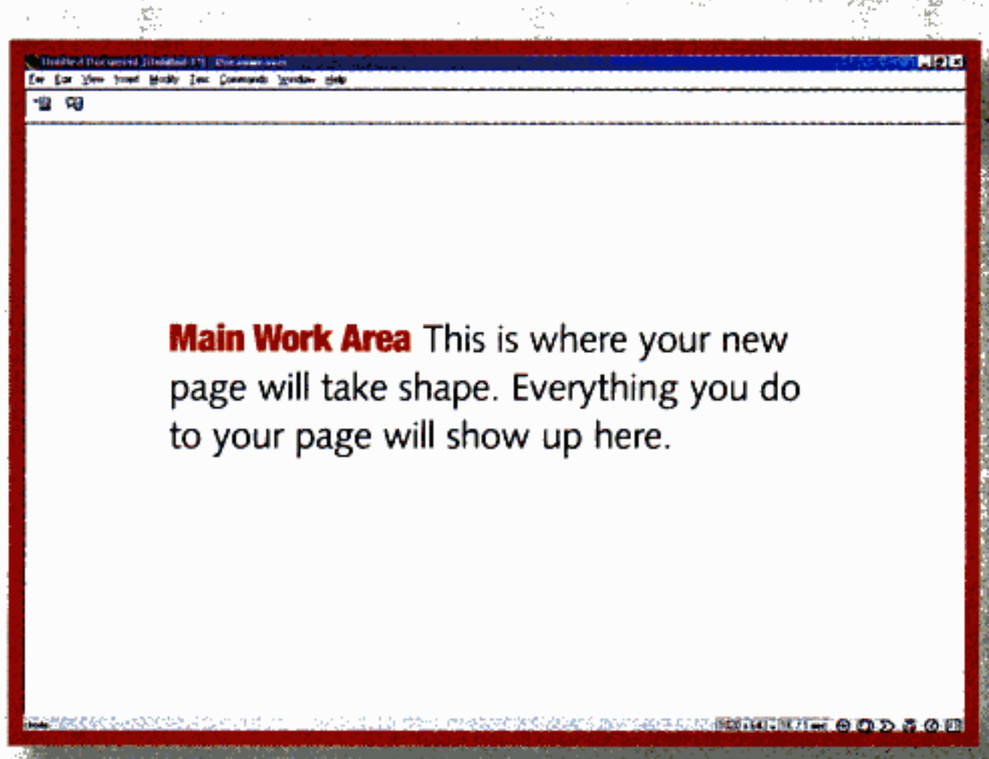
- **Image** Inserts onto your page an image from a folder you specify.
- **Table** Creates a table; you specify how many rows and columns.
- **HR** Makes a horizontal rule on your page; nice for splitting sections.
- **Layer** Allows you to make layers in order to position content; by far the easiest way to place things, and the way we'll do so for this project.
- **Applet** Places a Java applet into your page.
- **Active X** Places an Active X plug-in into your page.
- **Plugin** Places any other Netscape plug-in into your page.
- **Flash** Places a Macromedia Flash movie or animation.
- **Shockwave** Places a Macromedia Director Shockwave movie in your page.
- **Rollover** Helps you to create an image that will animate when a cursor rolls over it.

Launcher Opens and closes some of the more advanced windows from the work area, so you don't have to use hot keys or the pulldown menu.

- **Site** Used when making large sites; displays your site in either a linear or tree hierarchy, to help you manage pages.
- **Library** Accesses *Dreamweaver*'s library, where you can store frequently used images and text.
- **Styles** Used to apply specialized styles beyond the traditional text formats of bold, italic, and font changes.
- **Behavior** Used to assign an action that occurs, for example, when someone clicks on a certain point in the page, or when an animation finishes playing.
- **Timeline** Used to create animations without forcing you to use an animation program such as *Flash* or *Director*.
- **HTML** Accesses the HTML inspector, where you can check your code, modify existing code, or add your own. *Dreamweaver* uses "roundtrip HTML" so your code won't be unnecessarily changed when you save or alter a page.



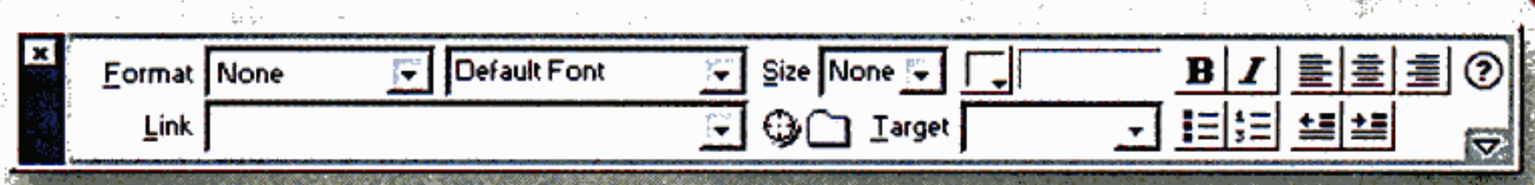




Main Work Area This is where your new page will take shape. Everything you do to your page will show up here.

Property Inspector Provides details on the elements you're working with in the main area, and allows you to change their attitudes.

- **Format** Changes text formatting and font category.
- **Size** Changes the base size of the text you're writing.
- **Link** Enables you to make a particular word the link to a URL, an e-mail address (in other words, a mailto command), or an FTP address.
- **Target** Allows you to link pages and frames within the same document.
- **Text Options** Creates lists, justifies text, indents text, and changes a font's color or attributes (i.e., bold and italic).



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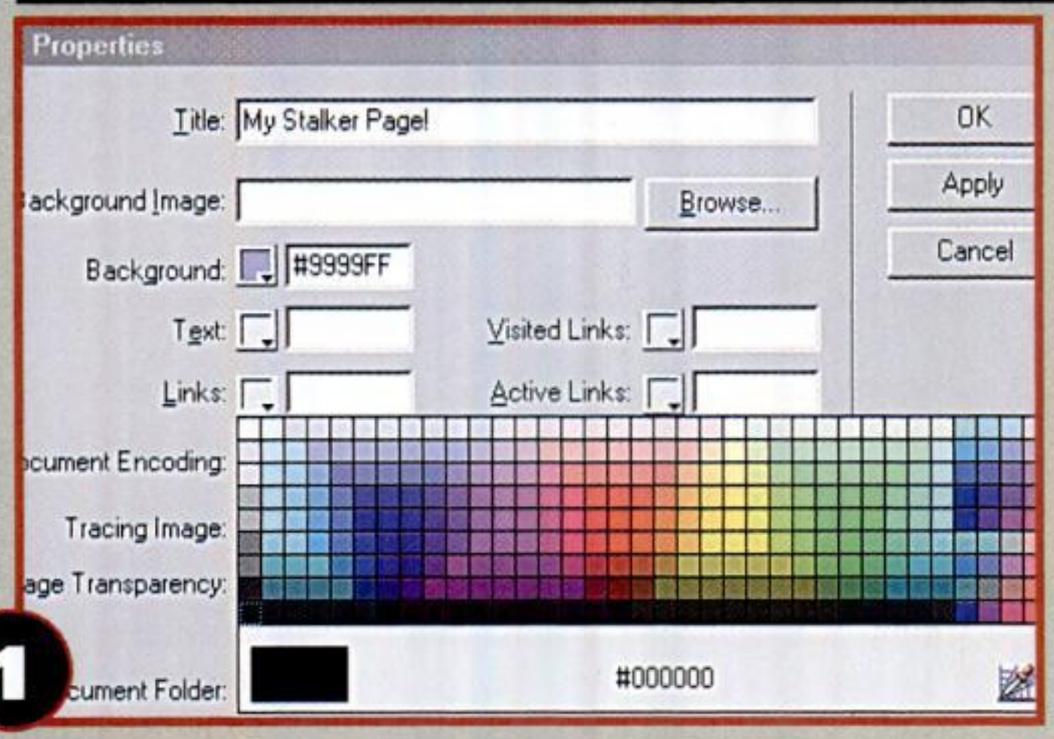
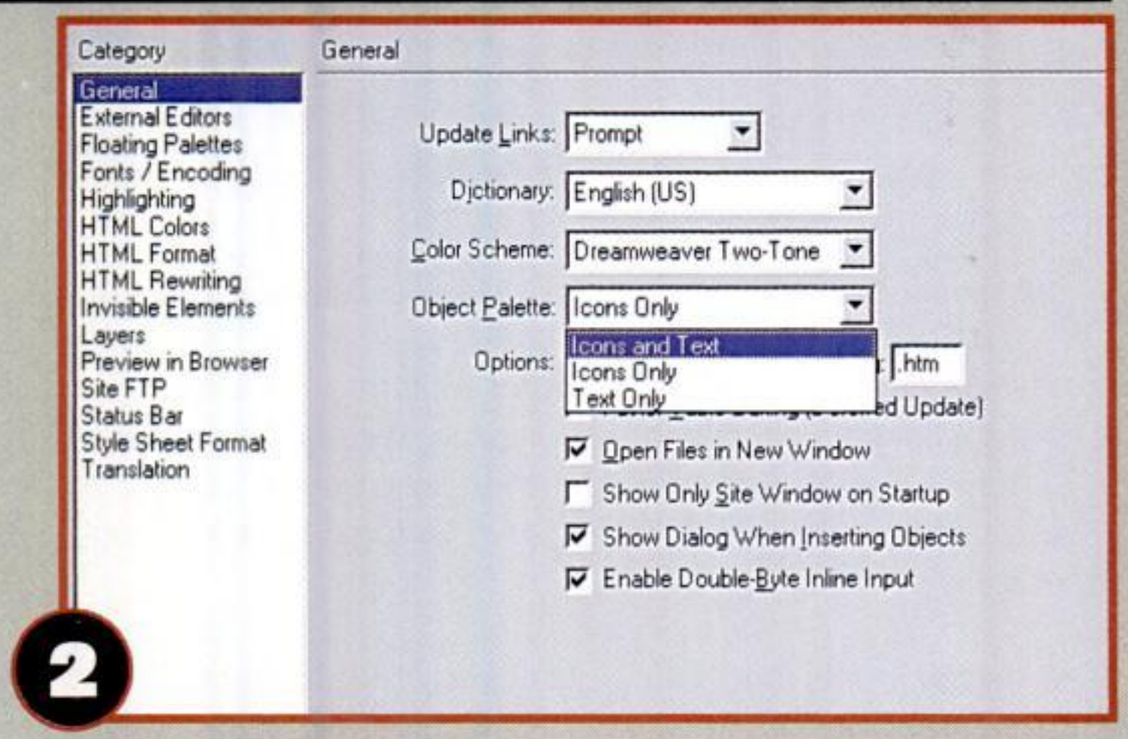
Stalking the Wily Editor in 23 Steps



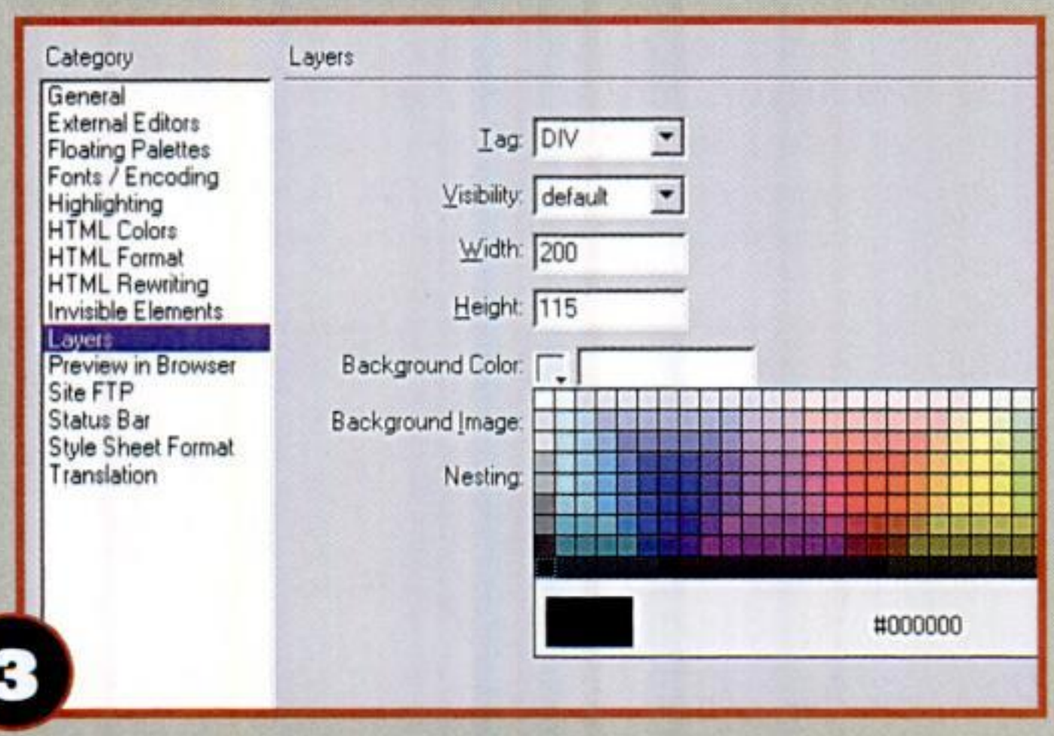
1

Save your page, go to the Modify menu, and select Page Properties. Title your page and choose a background. I went with solid colors—to illustrate the completeness of my obsession with the staff—but you can use an image if you prefer. Just click Browse and select an image from a folder. You can change text and link colors here, too.



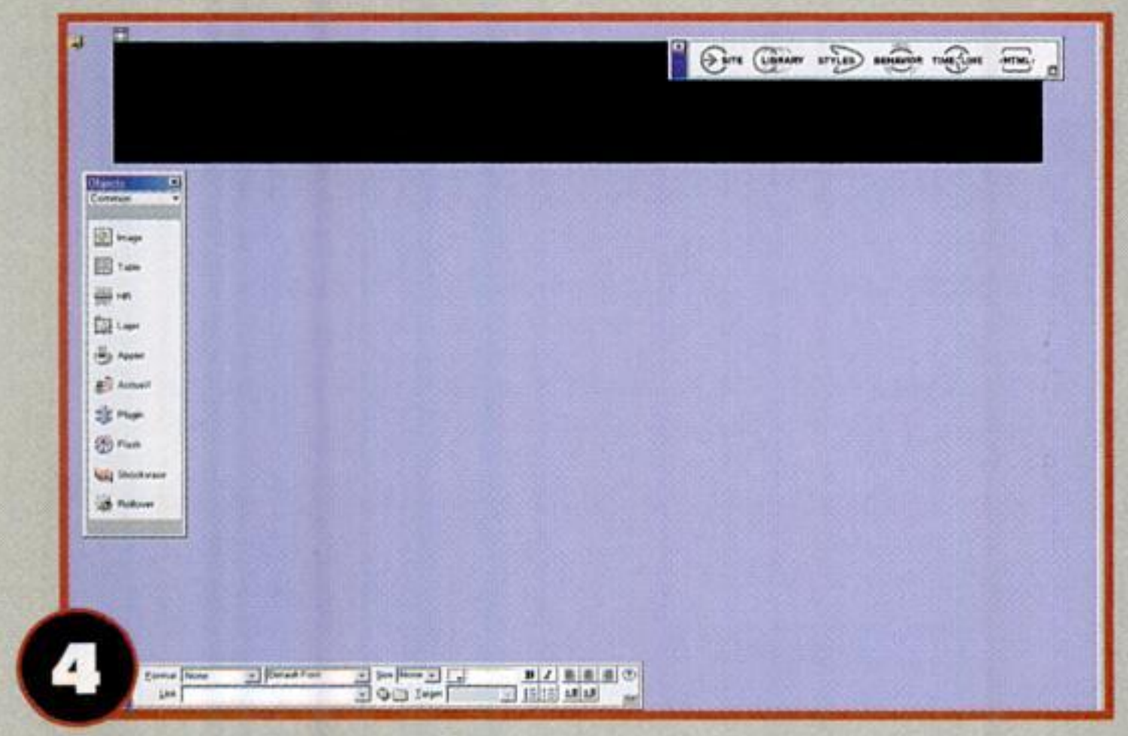
2

Now, we're going to modify a few preferences. From the Edit menu, click Preferences; a box containing a list of categories will open. Click General. Under Object Palette, click on the pull-down tab. Select Icons and Text; this allows you to see what the symbols on the palette mean. *Don't* click OK, because we're not done yet.



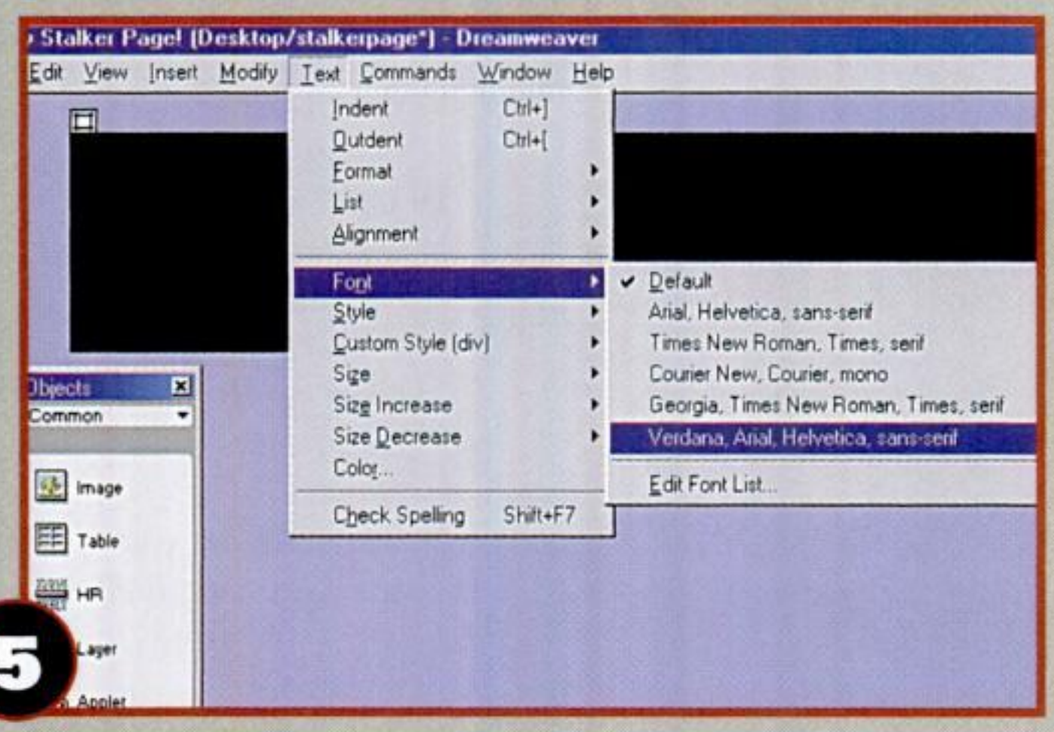
3

Under Categories, you'll see a Layer option. Click on it. When you see the Background Color option, choose black—the perfect color to represent the psyche of an eternally tortured soul. You'll see in a moment why we're doing this. Now, click OK, and return to the Main Work Area.



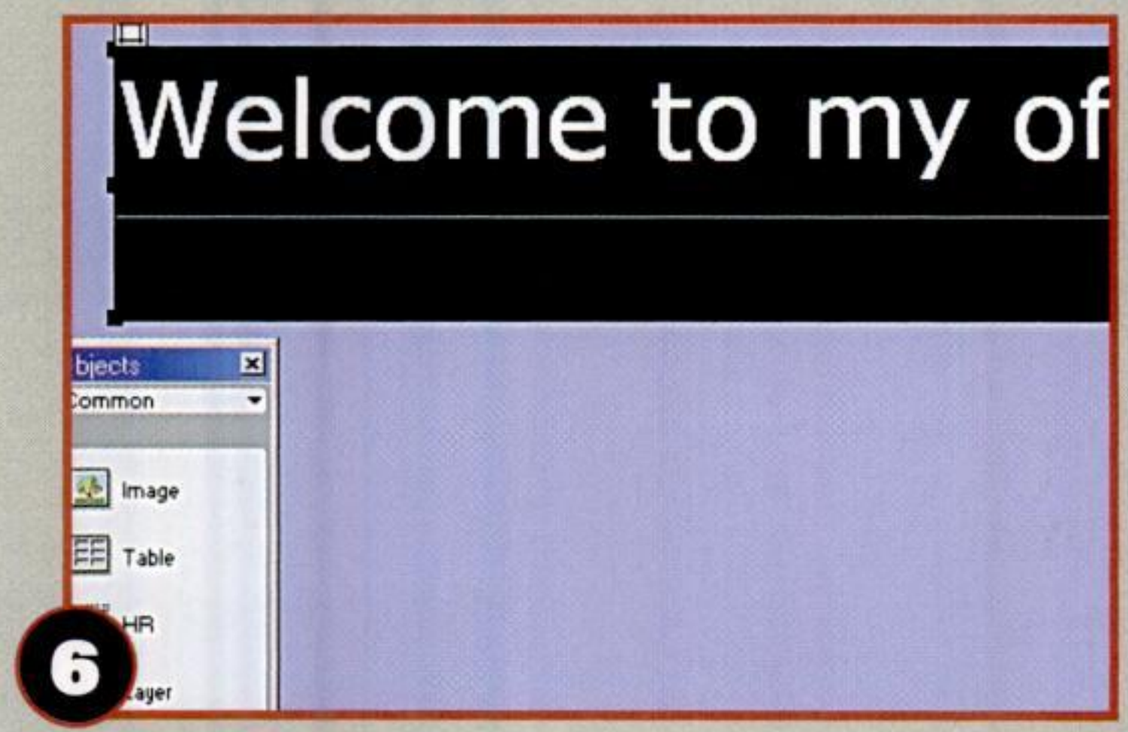
4

From the Objects Palette in the Main Work Area, select the Layer tool. Once you click on it, your cursor becomes a cross. Pick a point at the top left-hand corner of the page. Hold down the left mouse button and drag to form a rectangle. When you let go, the rectangle will turn black... like my sentiments for the oh-so-precious *Maximum PC* primadonnas! Congrats, you have created a layer.



5

There should be a cursor blinking in the upper left hand corner of the layer. If not, click inside the layer until one appears. Go to the Text menu, and scroll down to select a font. I chose type size 7, and colored it white. (These choices bear no psychopathological significance... Or do they?) Now, write your page's header line in the layer.



6

Move your cursor to the layer's border, where the cursor becomes a black cross. Click the left mouse button; little squares should appear around the layer. Put your cursor on these points, hold down the left mouse button, and drag to adjust the layer's size. You can move the entire layer by clicking anywhere else along its border and dragging.

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Hmmm...

"In our tests, PC performance increased by an average of 42% when moving from 32MB to 96MB of RAM."

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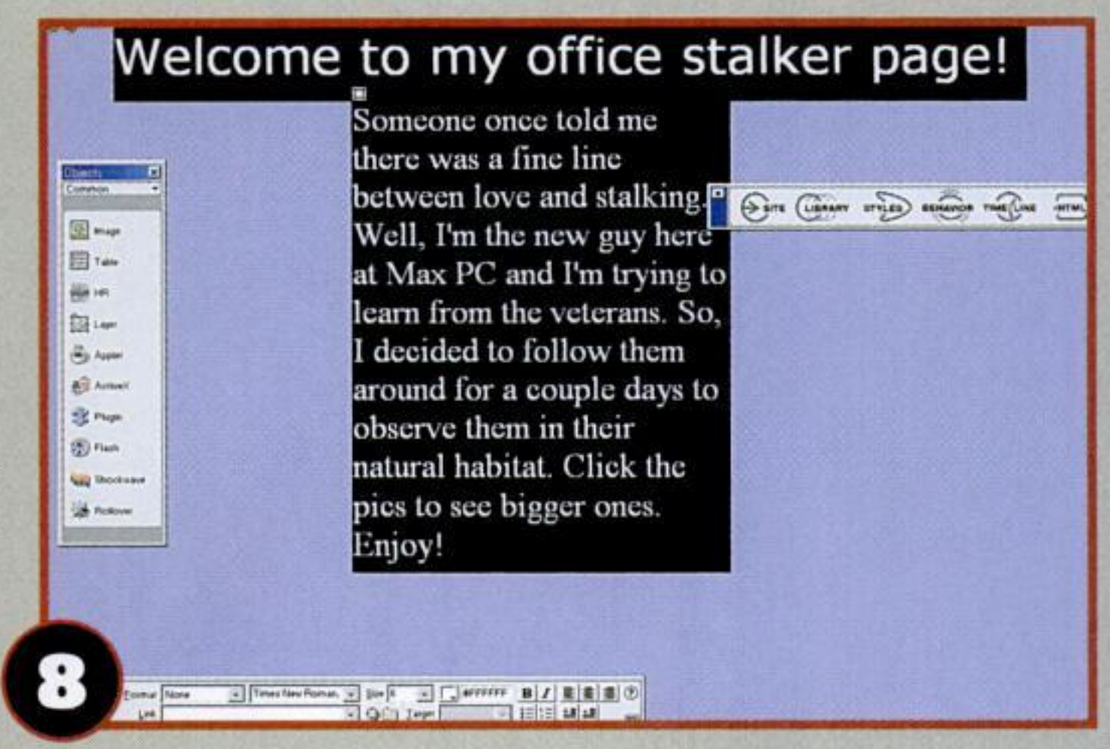
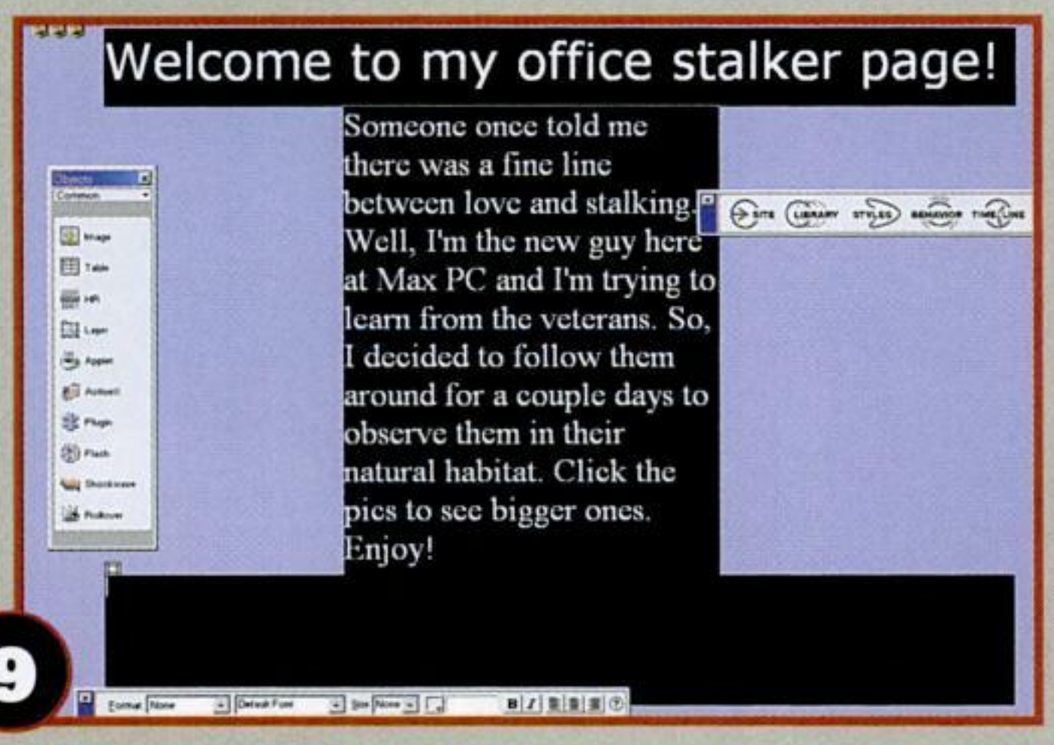
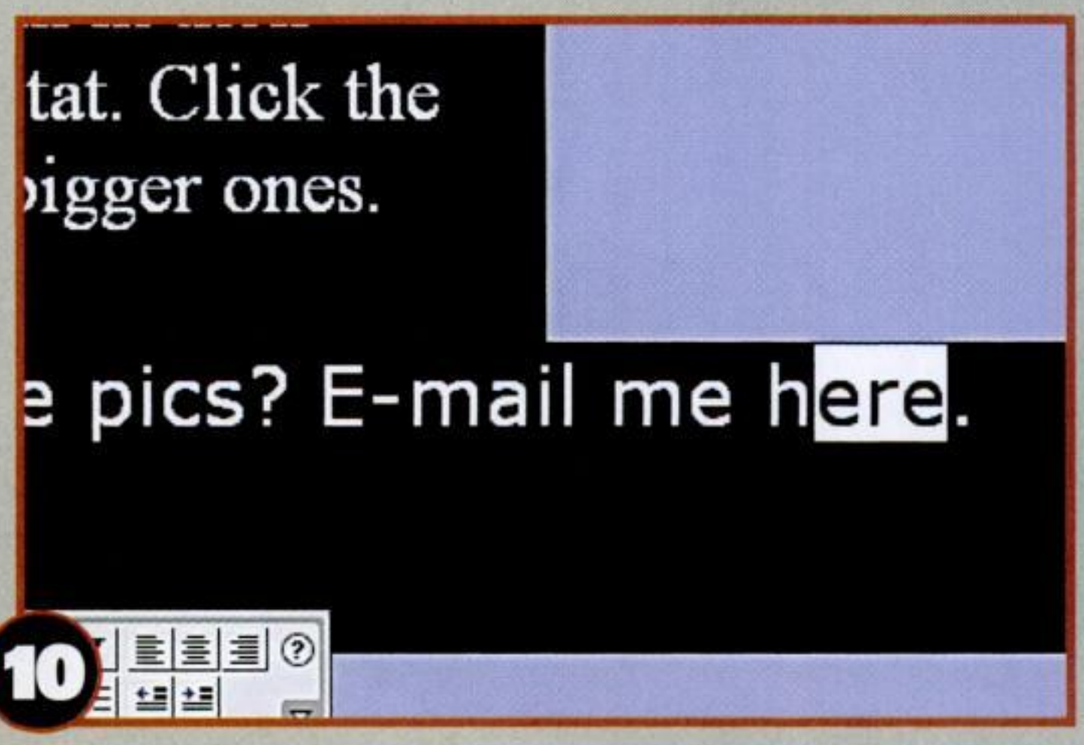
You remember how to make a layer, right? To make layers for each of your page's text boxes, repeat what we did in Step 4. I lined up two layers to make one piece that looks like a big T, but you don't have to follow my example. I repeat: Quit following me!



Text time again. Be sure the layer is selected and that you see a blinking cursor. Now, go to the Text menu and choose the attributes of your text. I chose a font from a different group (Times New Roman at size 5) to throw in a little variety. Now, write your manifesto.



I made another layer at the bottom of the one I just finished; its length is identical to the length of the first layer I made. I now have something that looks like a big black "I." It will be up to my new co-workers—and perhaps a psychoanalyst testifying in court—to decide whether this design element is a projection of my personality.



In the layer you just made, write the line: "Want to see some more pics? E-mail me here." Adjust the font, size, and color using the Text menu. When you're done, select the word "here" by highlighting it with your mouse.

Check out the Property Inspector Palette; it has a field called Link. Type in an appropriate mailto address, such as geoff@stalker.com. When a web surfer clicks on any text that's associated with a mailto link, his or her e-mail app will instantly open so a message can be sent to that e-mail address. Now, click on the layer. The word "here" should turn blue, because it's now an e-mail link.

Next, I added a web site link by typing a line below the one I just finished: "Want to see Maximum PC Online? Click here." Again, I highlighted the word "here" and went to the Link field in the Property Inspector. This time, I typed in a URL instead of a mailto address.

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Roy Turnbull, Principal Engineer

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Presario 5360	$286.00	99.89
Micron Electronics	Kingston	**Crucial**
Millennia 400	$286.00	99.89
Millennia 450	$286.00	99.89
Millennia MAX 450	$286.00	99.89
Gateway	Kingston	**Crucial**
G6-450	$286.00	99.89
G6-400	$286.00	99.89
Performance 450	$286.00	99.89
IBM	Kingston	**Crucial**
Aptiva (2153) Model E2U	$186.00	99.89
Aptiva (2139) Model E5D	$186.00	99.89
HP	Kingston	**Crucial**
Pavilion 4530	$286.00	99.89
Pavilion 4535	$286.00	99.89
Kayak XU PC Workstation 440BX Chipset	$207.00	110.69
Vectra VL Series 8	$186.00	99.89
Apple	Kingston	**Crucial**
Power Mac G3 PC100	$186.00	99.89
Power Mac G4	$286.00	99.89

Crucial prices reflect an automatic 10% discount for ordering online. Prices were taken from Crucial and Kingston Web sites on 11/15/99, however, they can (and do) change daily. Prices may vary according to specific system requirement.

Illustration by Jeremy Dennis

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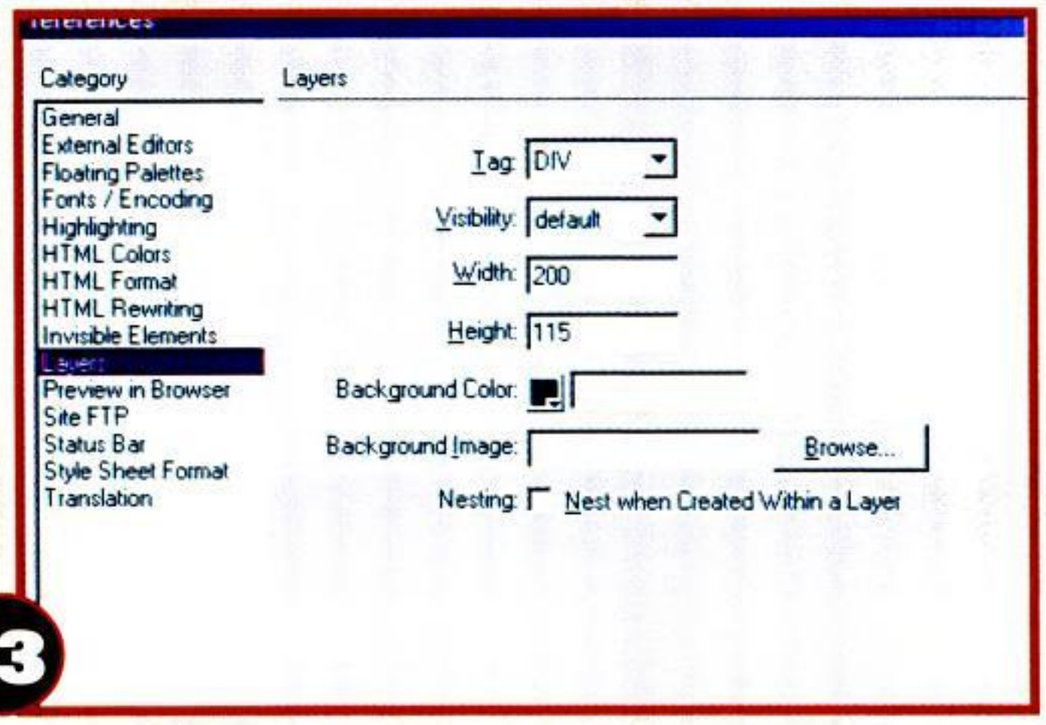
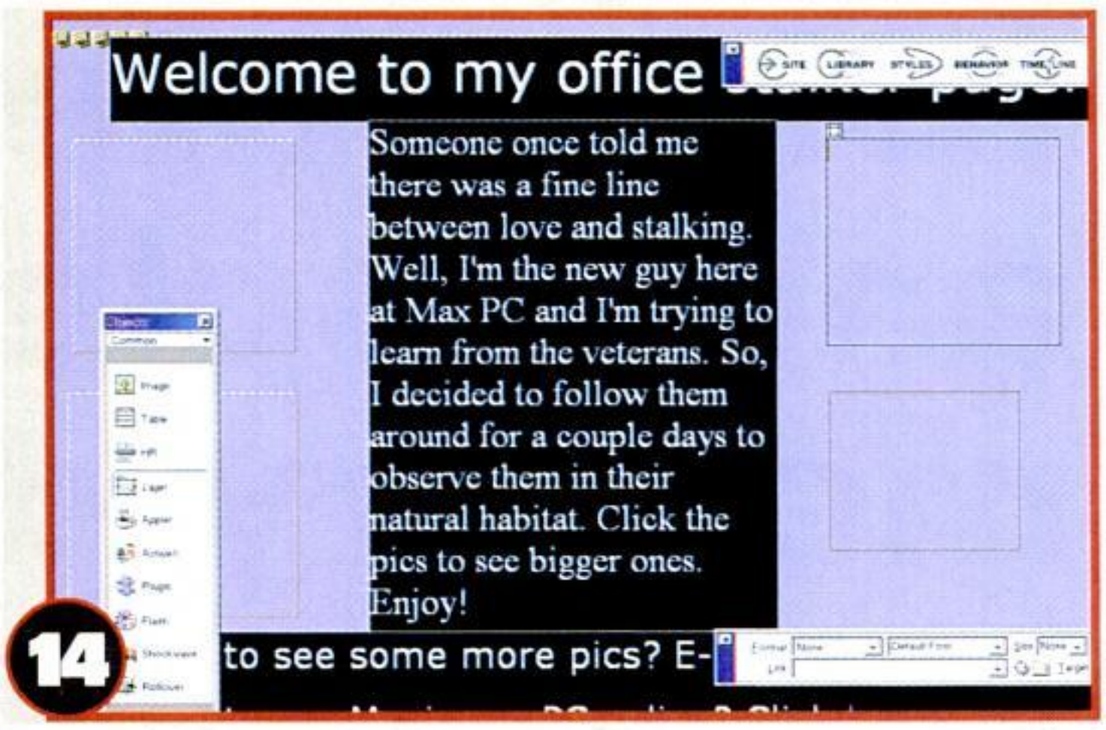
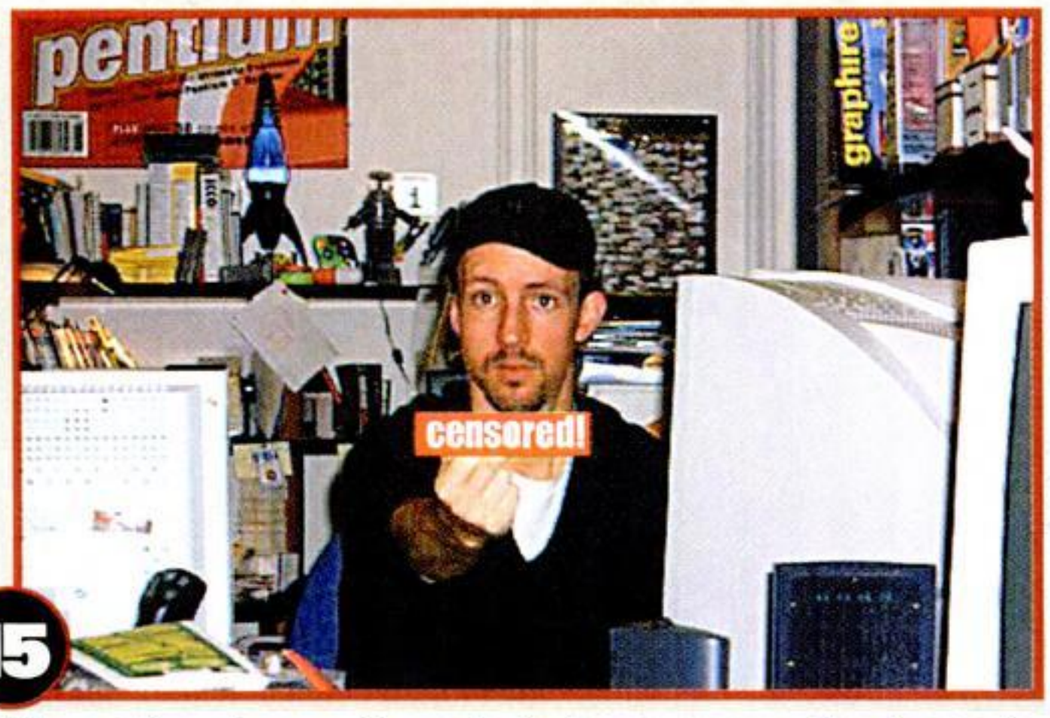


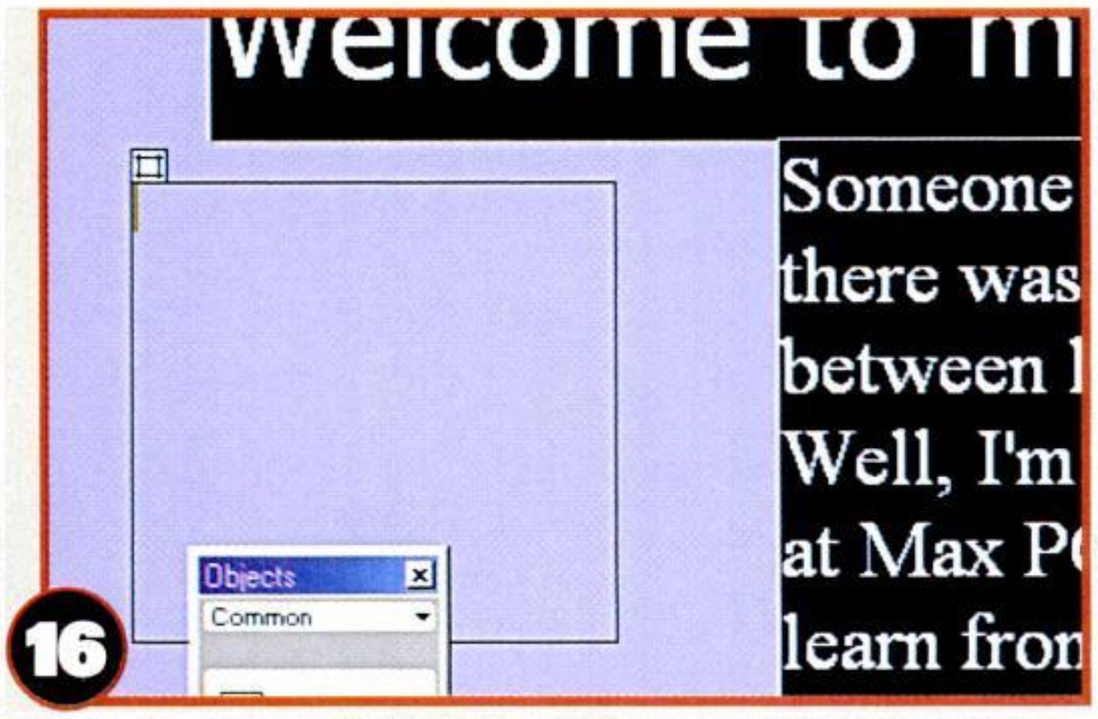
We're now going to build some layers that will house mouseover images. Go to the Edit menu and choose Preferences. Remember how we made the layers black? Under Background Color you will see #FFFFFF, which denotes the color black. Get rid of this, leaving that line blank, and hit OK. Your new layer will now be transparent.



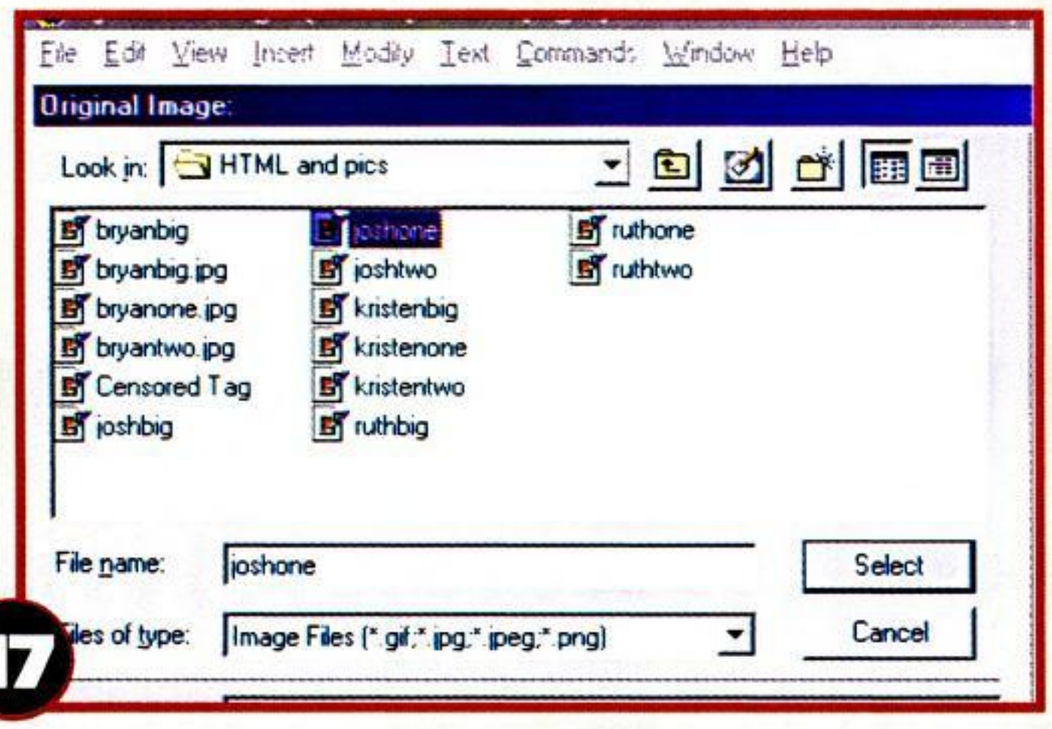
I created four transparent layers, and placed two on either side of the "I." Of course, it's *your* stalking site, buddy, so don't let me put a limit on the number of your "getting-to-know-ya" subjects. Go ahead and build as many image-containing layers as you want.



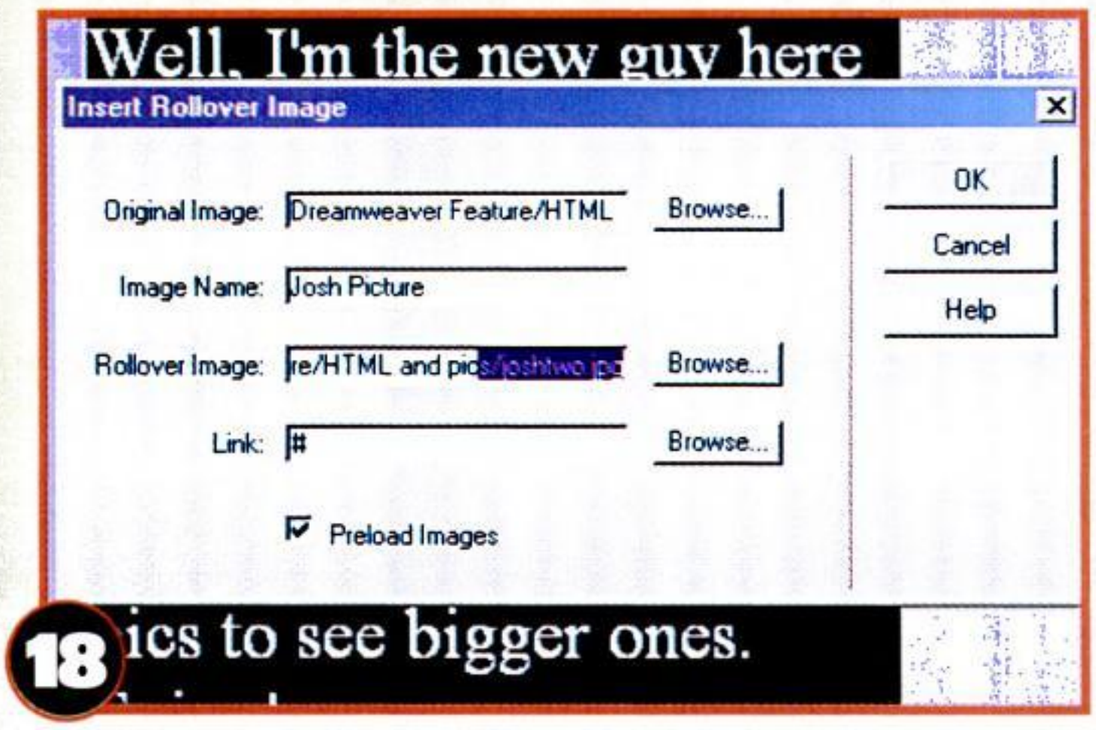
You'll need three images for each single mouseover: One image is what people will see when the page loads; one is what they'll see when their mouse floats over the mouseover layer; and one will appear when the user clicks on the layer. Confused? Just follow along. Trust me. Why would I lie to someone I have no intention of following home from work?



Click in the first empty layer to which you want to add an image, and make sure the blinking cursor is there. Get ready to visit the folder in which you should have already stored all of your edited images. (If they're too big, you can crop them directly in the *Dreamweaver 2* application).



Click on the Rollover button of the Object Palette. A window will appear. Under Original Image, click Browse and find the folder in which you've stored the first image of your three-image rollover animation. When you find it, hit Select. The name of your first image should now appear after Original Image. That's right: Image is everything in the world of personality transference.



Now, under Rollover Image, select Browse and choose the image you want people to see when the mouse rolls over the mouseover layer. Your second image name should now appear next to Rollover Image.

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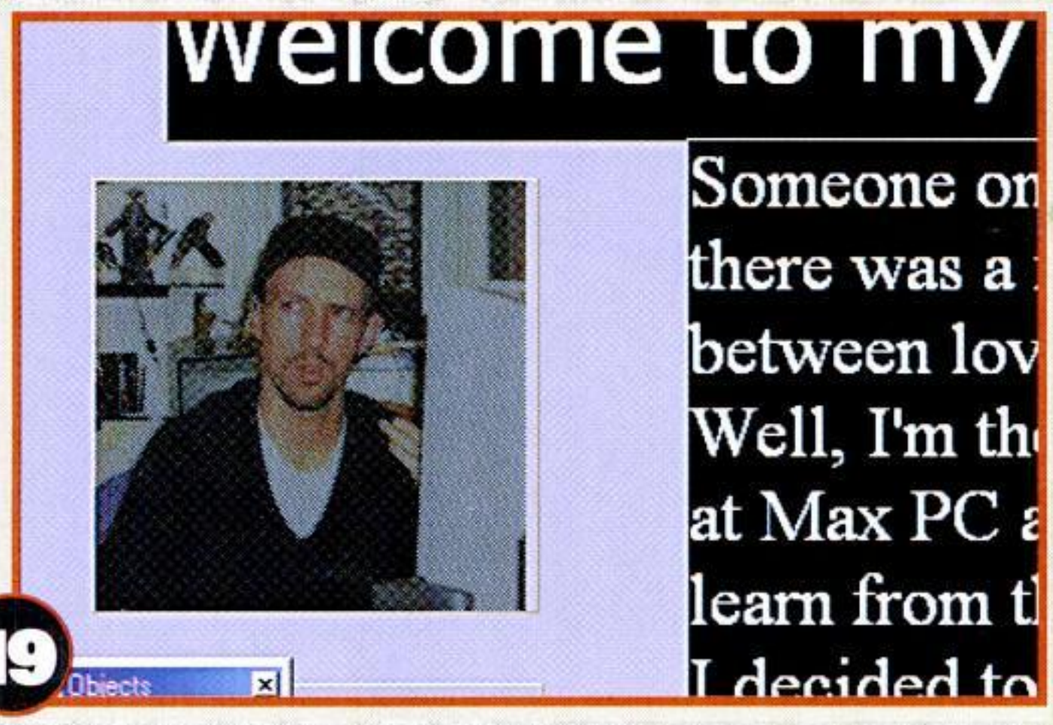
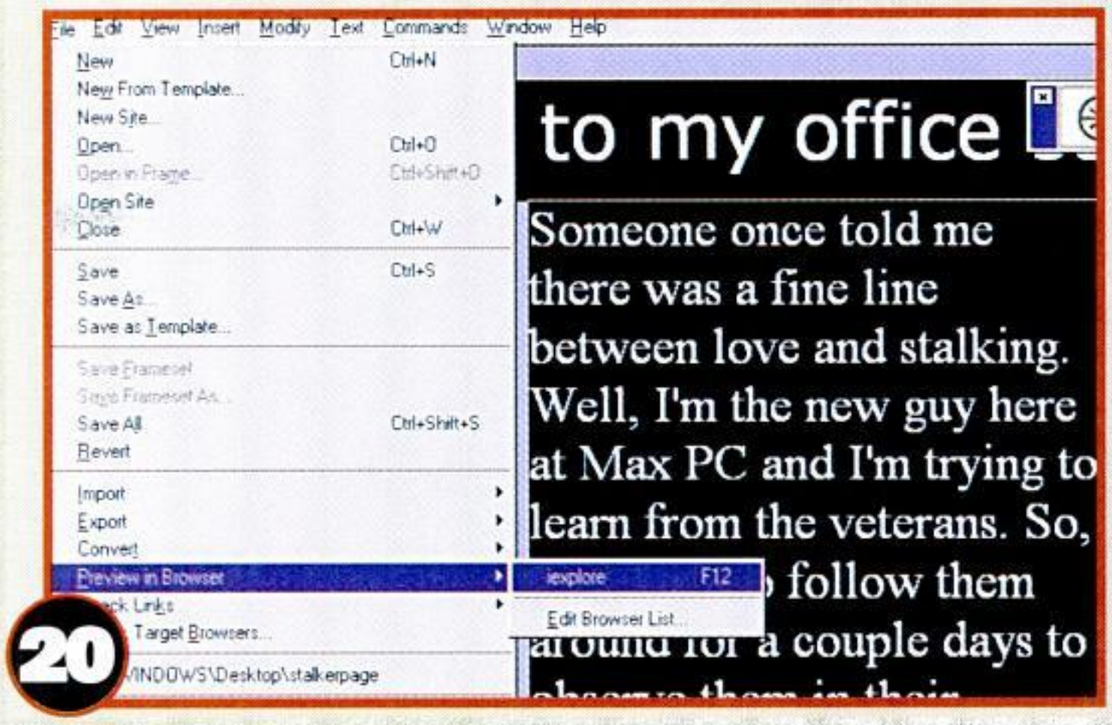


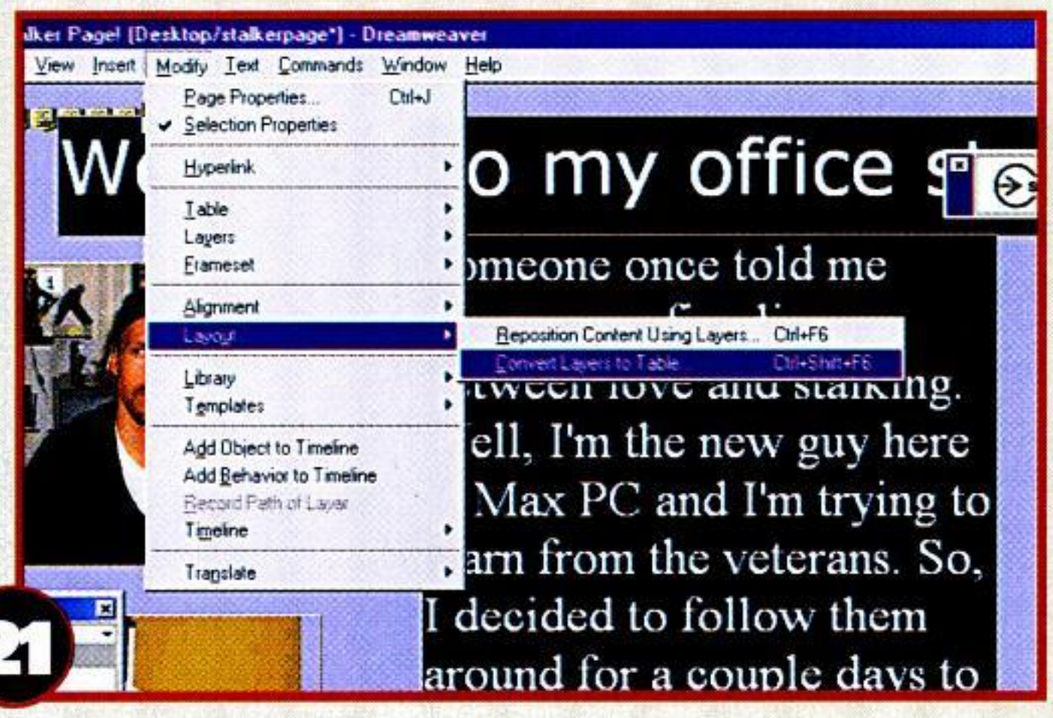
19

Next, under Link, hit Browse and select the image you want people to see when they click on the mouseover. Hit OK, and you'll see your *first* image displayed in the work area. Your mouseover is now loaded into your stalking site. Note: Mouseovers should be the *only* loaded weapons you use during your stalking exercises. A good rule to live by: Psychopaths are cute, but no one likes a sociopath.



20

Go to the File menu and select Preview in Browser. Netscape *Navigator* or *IE* will launch, and you'll see what happens when you run your mouse over an image. Click on the layer and it opens to your third picture. Pretty neat, eh? Don't worry if things look messed up in your browser; we'll fix that next. First, repeat Steps 15 through 19 to create mouseovers in other image layers.



21

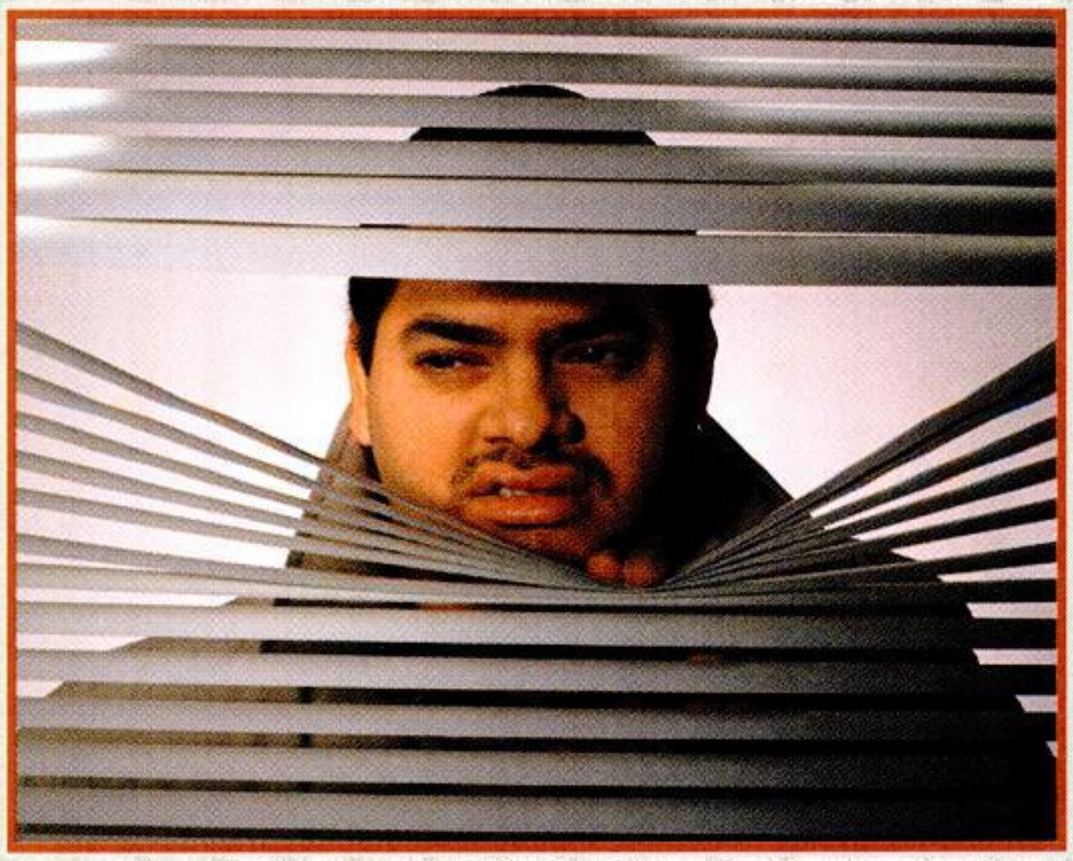
Now, go to the Modify menu and choose Layout. You'll be offered two options; choose Convert Layers to Tables. Layers are great tools to use during the actual design process because they're so easy to move around and manipulate. But because they aren't supported by older browsers, it's safer to convert them to tables, so your content will look uniform to everyone who views it.

22

Your page will now be covered in dotted lines. Don't fret; it's just displaying your newly converted HTML tables. If tables scare you and you want to adjust your page or change something, click Modify/Layout menu and select the first option, Reposition Content Using Layers. This takes you back to the layers interface.

23

You have officially arrived in the world of super-stalking! What now? Be sure to save your work, and then experiment! Make more pages, play with *Dreamweaver 2*, and go online to find free web site hosting services. Three good candidates include Angelfire, Geocities, and Tripod—not only are they free, but their pop-up ads will annoy the hell out of police authorities who come to visit! You've taken the first step. The rest is limited only by time and restraining orders. ✹



See Geoff's psycho-stalking site at **www.maximumpc.com** *in the Re:print section.*

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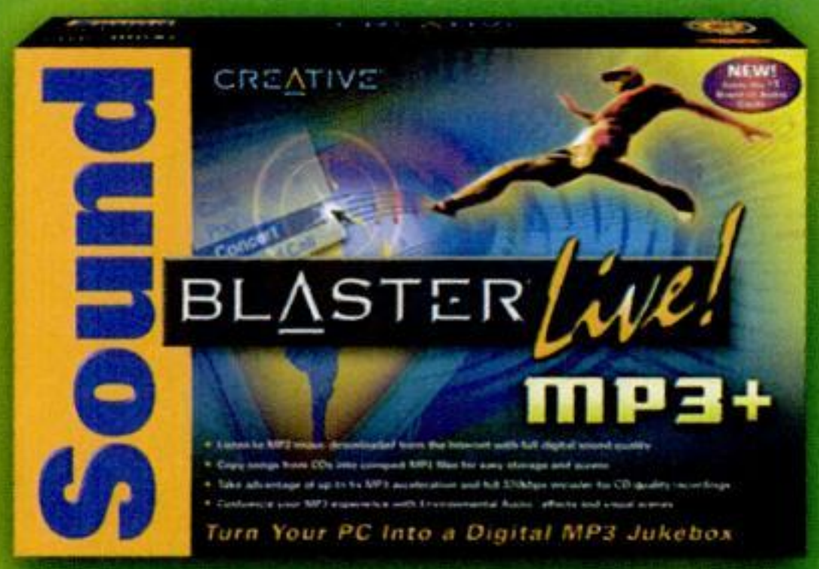

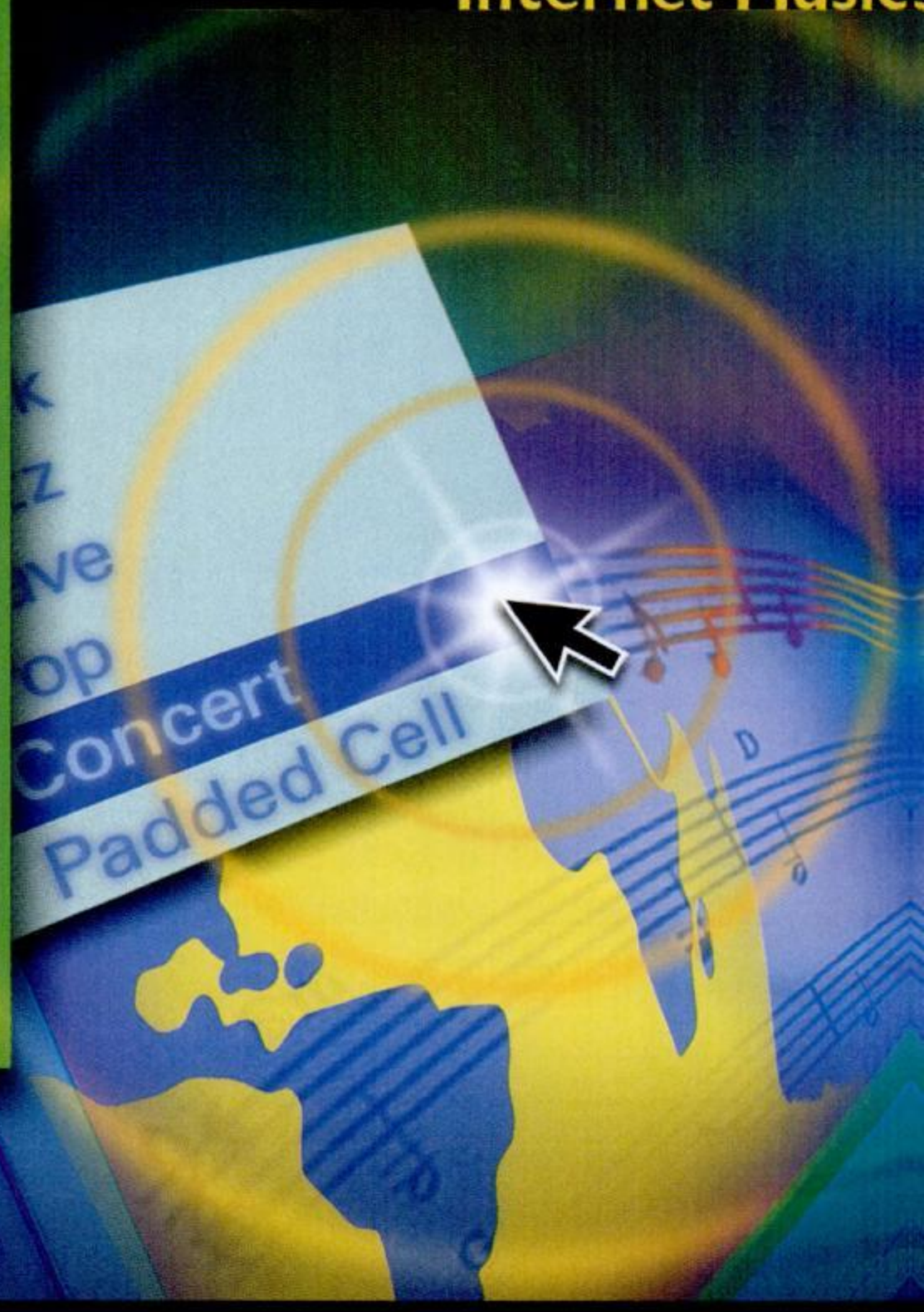

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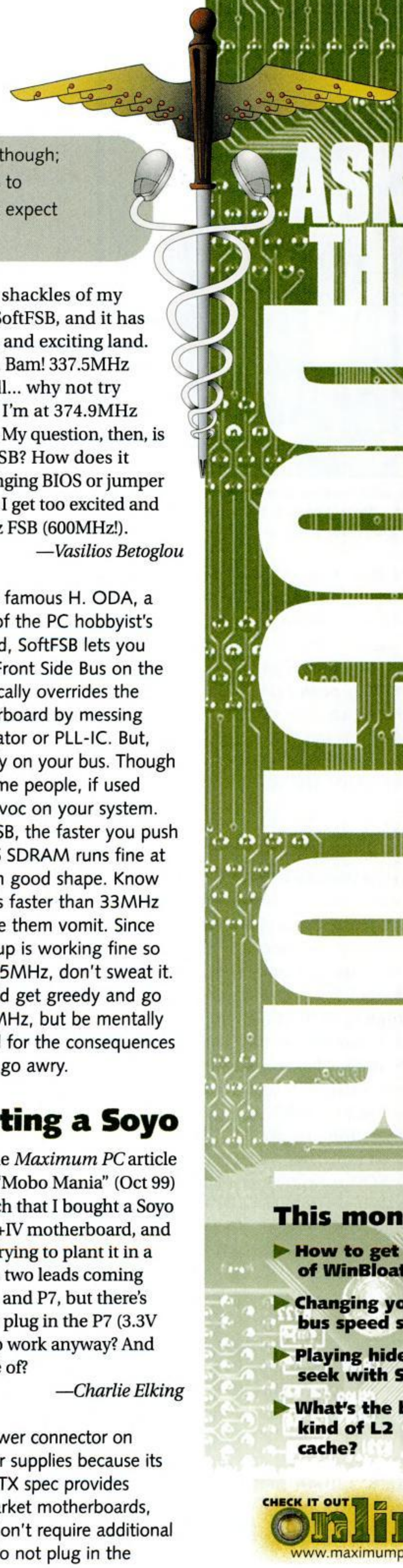
Symptom | Diagnosis | Cure

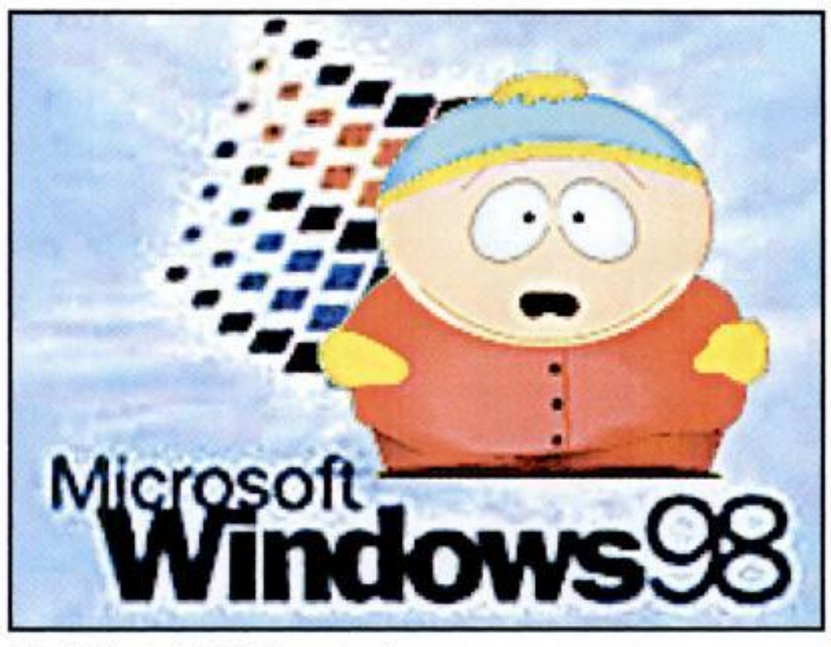
We've all been to the land of PC malfunction, and it's hell on earth. Don't worry though; the Doctor is now in. For a diagnosis of your PC's problems, send your symptoms to **doctor@maximumpc.com**. The waiting room is currently backed up, so don't expect a personal answer immediately; we'll do our best to address your problem STAT.



Reducing system flab

Can you help me speed up my computer? Fresh out of the box, it was nice and peppy with lots of system resources. Now, it has lots of programs and little icons in the system tray, and it drags its butt. I was constantly getting messages from Norton about the system resources being low, so I increased RAM to 96MB from 32MB. But I'm still not content. What should I be doing?

—Anonymous



I feel bloated! It's time to dump some apps.

One word—Windows. Over time, Windows gets fat and bloated. Sure, it's snappy in the first few months, but eventually it settles down with a vat of ice cream and turns into the PC equivalent of Eric Cartman. One solution is a scorched Earth policy: Either DELTREE the Windows directory and Program directories in DOS (after backing up valuable data), or reformat the entire disk before reloading Windows. Or, if your stomach isn't strong enough to handle napalming your drive, you can do some housekeeping and clear out many of the fatty tissues clogging your system. For tips on tidying up your Registry and rousting layabout programs from your Startup Directory, see Step 7 of the February 1999 *Maximum PC* feature, "Christen Your System," or visit the Re:print section at **www.maximumpc.com** for the same info.

"Its name is SoftFSB, and it has allowed me to enter a new and exciting land. I set the FSB to 75MHz and Bam! 337.5MHz bliss."

Get out and push the bus

I have an Intel Pentium II 300MHz (66MHz x 4.5). Two days ago, I came across a magical program that released me from the shackles of my shoddy BIOS. Its name is SoftFSB, and it has allowed me to enter a new and exciting land. I set the FSB to 75MHz and, Bam! 337.5MHz bliss. Then I thought, "Well... why not try 83.3MHz FSB?" It worked! I'm at 374.9MHz and haven't had any issues. My question, then, is what's the deal with SoftFSB? How does it work? Is it the same as changing BIOS or jumper settings? Please help before I get too excited and run this baby up to 133MHz FSB (600MHz!).

—Vasilios Betoglou

SoftFSB was written by the famous H. ODA, a regular Samuel L. Jackson of the PC hobbyist's world. As you've discovered, SoftFSB lets you change the speed of your Front Side Bus on the fly within Windows. It basically overrides the bus speeds for your motherboard by messing with your PC's clock generator or PLL-IC. But, we suggest you tread lightly on your bus. Though SoftFSB is a godsend to some people, if used improperly, it will wreak havoc on your system. The more you push your FSB, the faster you push your memory. If your PC66 SDRAM runs fine at the higher speeds, you're in good shape. Know that running your PCI cards faster than 33MHz can make them vomit. Since your setup is working fine so far at 375MHz, don't sweat it. You could get greedy and go for 500MHz, but be mentally prepared for the consequences if things go awry.

Planting a Soyo

I liked the *Maximum PC* article about "Mobo Mania" (Oct 99) so much that I bought a Soyo SY6BA+IV motherboard, and am now trying to plant it in a Dell XPS T450. The Dell has two leads coming out of the power supply, P1 and P7, but there's no place on Soyo's mobo to plug in the P7 (3.3V power input). Will the setup work anyway? And what else should I be aware of?

—Charlie Elking

Dell uses an auxiliary P7 power connector on its motherboards and power supplies because its engineers don't think the ATX spec provides enough juice. Most aftermarket motherboards, such as Soyo's SY6BA+IV, don't require additional power, though, so it's fine to not plug in the

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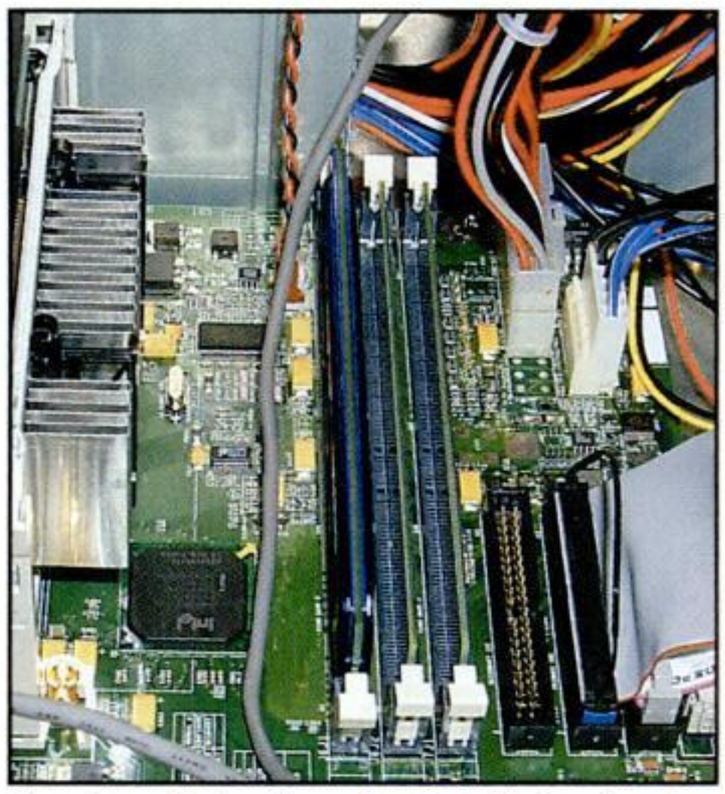

The plug with the blue wires is Dell's handiwork. Your mobo doesn't need it, but you may have cable length issues when upgrading.

auxiliary plug. Just be sure to tape up the extra adapter, to ensure that it doesn't short anything out on the mobo.

We actually think that you may face another problem altogether: It's likely that the Dell's power cables won't actually reach the appropriate slot on the Soyo board. If this is the case, you'll need to buy a new power supply that pumps between 250W to 300W, and you'll be good to go.

SCSI go bye-bye

My PC runs Windows 98 SE with an Adaptec 2940Ultra Wide SCSI controller connected to a 9GB Seagate hard drive. This configuration boots and runs well, but when I add a second 9GB Seagate HD (same model, same specs), the PC won't boot properly. At bootup, Windows 98 starts to enumerate all the drivers, but the SCSI drivers fail and don't load, so Windows partially starts up but the SCSI drives are not available. If I remove the SCSI driver from the System Properties and restart the system, Win98 detects the new SCSI controller and loads the drivers—when I do this, both drives are available and they function perfectly under Windows. Why is this happening?

—Joe Magri

Playing hide-and-seek with SCSI drives is no fun at all, but since you sound SCSI savvy, we'll assume that only the drive on the end of the SCSI cable is terminated, and that both drives have different SCSI IDs assigned to them. Improper termination and ID conflicts can cause a total failure (usually) or intermittent problems (for sure) in your system, and will make OSes, especially Win98, act unruly.

Funny thing is, we've seen this same problem with an install of Win98 and IDE drives—they disappeared or wouldn't load correctly when DMA was enabled. That was in a system with two PCI bridge chips (any motherboards using more than 4 PCI slots requires two PCI bridges). We found that moving the card onto one of the first few PCI slots made Windows recognize the drives and load them properly.

Cache to on-die for

What's the difference between an on-die L2 cache and SRAM cache? Is one better than the other?

—Se Choi

External SRAM cache is generally mounted on the motherboard or in the CPU cartridge, whereas on-die cache is etched on the same die as the CPU. Cache is similar to your CPU in that it has a clock speed, which determines its performance. In Pentium II and Klamath/Deschutes/Katmai-based Pentium III processors, the cache is half the speed of the CPU (e.g., a P-III 500 will have cache running at 250MHz). In Celeron processors, which have on-die cache, the cache operates at full clock speed. There happens to be less cache on a Celeron than on a P-III processor (a Celeron has a 128K, vs. 512K on a P-III), but the fact that the Celeron's cache operates at full clock speed makes up for the small amount.

Which is better? It depends on what you're using the machine for. Desktop apps and databases are heavily cache-dependent, but games rarely use cache. In any case, it's likely that all next-gen procs will have on-die cache, since it operates at faster speeds and allows for smaller procs. Don't believe us? Intel's Coppermine CPU boasts 256KB of on-die cache at full speed, with more L2 cache on the drawing board.

"It's likely the Dell's power cables won't actually reach the appropriate slot on the Soyo board."

Like most first-production K6-IIIs, this one runs at 2.4 volts, but newer K6-IIIs are running at a cooler 2.2 volts.

My mouse is on crack

When I right-click on the submenus located in the Windows start menu, the graphical portion of my pointer shoots 10 inches up my screen, rendering it useless. Microsoft's web page acknowledges the bug, but only for older OSes (I used to have an old version of Win98, but I am now running the Second Edition). The help file suggests I go to Control Panel>Keyboard>Pointer Activity and adjust the "SnapTo" option, but that tab doesn't exist on my version of Win98. Also, the download they supply on the site gives me the pleasant message, "This is not meant for Windows 98." Please help!

—Lance Semak

Some cases of erratic mouse-pointer movement have been traced to the Microsoft *Intellitype* (version 1.1) software and the way it interoperates with *Internet Explorer 4.0* and greater. The update you downloaded was indeed designed for Windows 95, but you can obtain an updated version for Windows 98 directly from Microsoft. Either download the *Intellipoint 3.0* software update from **www.microsoft.com/products/hardware/mouse/driver/drivers_pc.htm** or contact the Microsoft Order Desk at 800.360.7561.

It's also possible that your computer's manufacturer included some software on your computer that's causing the mouse behavior. Windows 98 includes a troubleshooting tool called MSCONFIG that can be run by typing MSCONFIG.EXE in the Start Menu>Run dialog. Once you've launched this tool, choose Selective Startup from the General tab, then uncheck the Load Startup Group Item option. Click OK and restart your system. If the problem is resolved, one of your Startup group items is probably the cause. Using MSCONFIG, you can selectively uncheck each Startup Group item until the offending program can be pinpointed. If the cause is still undetermined, you may have a unique problem that will require troubleshooting by your PC vendor.

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Our product evaluation process is built on down-and-dirty, hands-on testing. All hardware benchmarking is conducted in the *Maximum PC* lab by *Maximum PC* editors, and whenever possible, we use real-world applications to gauge performance. Our final verdicts, which fall on a scale from 1 to 10, are based on both benchmark results and a subjective appraisal of product features.

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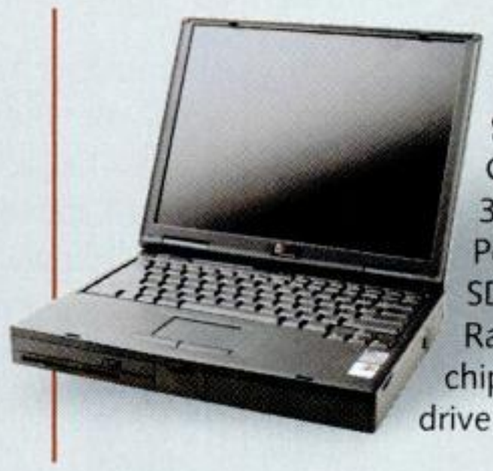
How to Read the Benchmarks

Our Dell Dimension test system is used to establish zero points for all desktop benchmarking and as a test bed for individual component evaluation. The Quantex notebook serves the same purpose for notebook reviews. The base system scores represent the average acceptable performance of high-end machines as of 07/99. We will update the mid-point systems every six months with machines from different OEMs.

DESKTOP ZERO-POINT SYSTEM: Dell Dimension XPS T500: P-III 500MHz, 440BX chipset, 128MB 100MHz SDRAM, 32MB TNT2 videocard, 12.7GB 7200rpm UDMA/33 hard drive, 40x (advertised speed) CD-ROM.



NOTEBOOK ZERO-POINT SYSTEM: Quantex I-1410: 366MHz mobile Pentium II, 96MB SDRAM, 8MB ATI Rage LT Pro video chipset, 8GB hard drive, 4x DVD-ROM.

Desktop Systems

The specific score achieved by the system.

The mid-points denote "acceptable performance" and are based on the precise scores achieved by our base Dell and Quantex systems. As we review new systems each month, their benchmark scores will fall either below or above the mark of acceptable performance.

The more a system underperforms the mid-point system, the further into the red its bar moves. The numbers shown at the low-point are the lowest scores we expect to see in any shipping product.

The more a system outperforms the mid-point system, the further into the green its bar moves. The numbers shown at the high-point are the best scores we expect to see in the next six months.

KICKIN' THE TIRES ON THE LATEST HARDWARE AND TAKIN' THE LATEST SOFTWARE OUT FOR A SPIN

Hardware Photography by **AARON LAUER**

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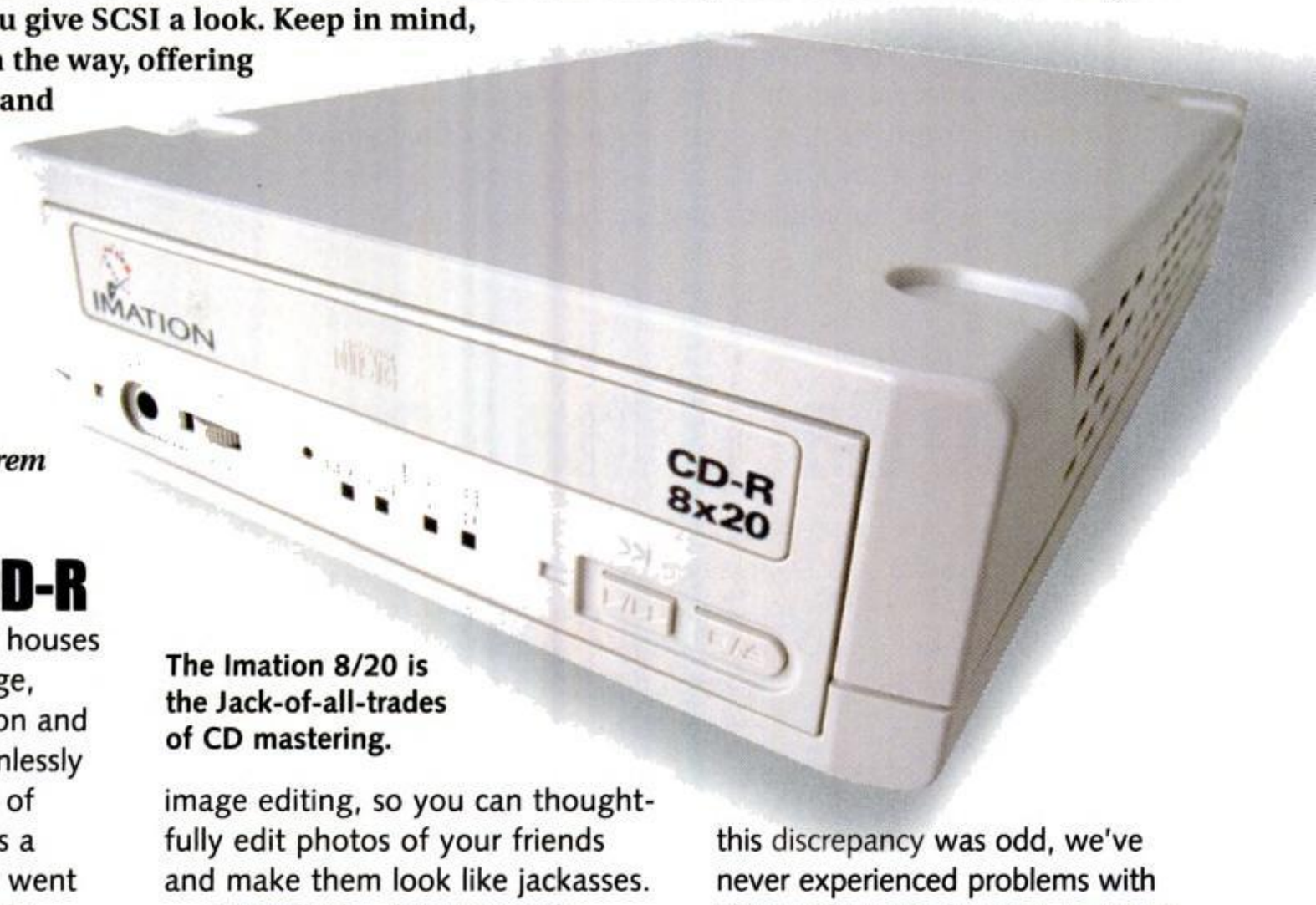
CD-Rrrroundup!

JUST WHAT EVERYONE NEEDS—MORE STORAGE

Back in our day, we didn't have any of this CD-RW malarkey. No sir, we had to copy CDs by hand! In the snow! But now we have CD burners to do the work for us, and SCSI drives are the cream of the crop. Their CPU utilization scores, typically ranging from 1% to 2%, put IDE drives to shame and leave your CPU free to perform other tasks while you're duping. And SCSI is the most dependable channel you could ever trust your expensive media with; once you begin burning, nothing short of an 8.0 earthquake will leave you with a bad burn and the inevitable coaster. Buffer underruns hardly ever occur with SCSI, so unless you're short on Frisbees for your dog to fetch, we suggest you give SCSI a look. Keep in mind, though, that DVD-RW is on the way, offering multi-gig storage capacity and backwards compatibility with existing DVD-ROM drives. Whether it'll be worth the price of admission is yet to be determined, so for now, SCSI CD burning reigns supreme.

—Josh Norem



The Imation 8/20 is the Jack-of-all-trades of CD mastering.

Imation 8/20 CD-R

The Imation Super Recorder houses a Plextor 8x20 drive in a large, rugged shell. SCSI termination and ID selection are handled painlessly via a small knob on the rear of the unit, and installation was a two-minute affair. The drive went head-to-head with the slightly faster Teac that's also reviewed here, but thanks to the Imation's generous software bundle, the two drives emerged from the showdown on nearly equal footing.

PLUSES
- Software cornucopia
- Mac software for traitors

MINUSES
- Audio extraction problematic
- Price is number of the beast

THE SPECS

MODEL	Super Recorder 8x20
INTERNAL BUFFER SIZE	4MB
INTERFACE	SCSI-2
SCSI CARD INCLUDED	Adaptec 2930c
SUPPORT FOR OVER-BURNING	Yes
RECORDING METHODS	Disk-at-Once | Track-at-Once | Multisession | Variable & fixed packet writing

Of the drives in this roundup, the Imation is truly the Jack-of-all-trades. Its CD-mastering package features the full assortment of Adaptec mastering software, including *Easy CD Creator, CD Copier,* and *Direct CD*, along with a host of other programs. Even Macintosh versions of Adaptec *Toast* and *Direct CD* are bundled—and though around here we prefer PCs to Macs any day of the week, we know some of you are playing on both teams, so it's nice to have options. Everything from audio editing software (*Sound Forge*) to disk recovery tools (Plextor *CD Res-Q*) rounds out the bundle. Imation was even thoughtful enough to include *LivePix Deluxe* for image editing, so you can thought-fully edit photos of your friends and make them look like jackasses.

Overall, the drive's speeds were on the level of what we'd expect from an 8x20 drive, but for reasons we cannot explain, this discrepancy was odd, we've never experienced problems with Plextor drives in the past, so we're not too concerned.

The combination of the Plextor drive and Imation's killer software bundle makes the 8/20 a worthy

DARE TO COMPARE

MANUFACTURER / CD TACH	IMATION SUPER RECORDER	TEAC 8X24	PLEXTOR PLEXWRITER
Drive rating	13.4x	15.1x	14.1x
Minimum sequential read time	1.39MB/sec	1.49MB/sec	1.35MB/sec
Maximum sequential read time	2.92MB/sec	3.02MB/sec	2.96MB/sec
Full stroke/random access times (in milliseconds)	296/141	249/157	311/150
CPU utilization (minimum/maximum)	1%/6%	1%/5%	1%/6%

the Imation repeatedly failed the extraction test we performed with *Audio Catalyst* software. Since our deadline was looming, we put in a call to Imation tech support. After waiting half an hour on hold, we decided to just try using *Easy CD Creator* instead. The drive performed as expected and took just 7 minutes, 22 seconds to burn the 11 audio tracks used for testing. Although package. Imation even includes an Adaptec SCSI card, so first-timers can start "backing up" CDs in no time.

MAXIMUM PC VERDICT

Price $577 internal kit, $666 external kit
Company Imation
Phone 888.466.3456
URL www.imation.com

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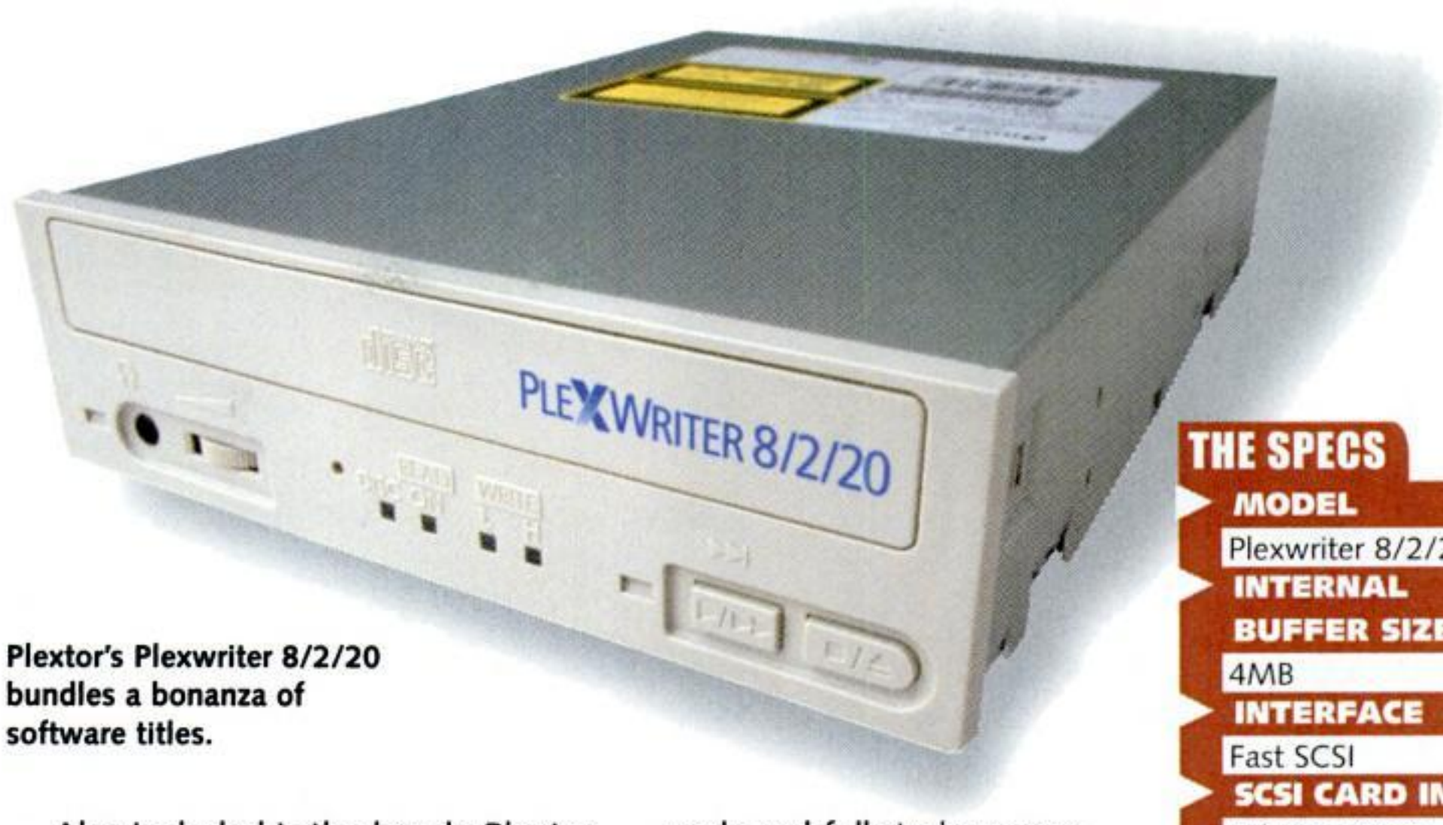
Plexwriter 8/2/20

In the CD-R/RW world, Plextor is king. Its drives are lickity-split fast, built like a rock, and include Plextor's awesome *Plexmanager 2000* software. Though Plexwriter is no longer the speed king—other companies have also delivered 8x drives—it still brings more to the table than any other drive in this roundup.

The software bundle is extremely intuitive and includes everything we'd ever want for data, music, or mixed-mode CD duplication. Duping duties are handled by either the Adaptec mastering software, which we love, or Plextor's slick *DiscDupe* program, which is so easy to use, it's almost an insult to our intelligence. Capturing audio is also a breeze, as the *Plexmanager* lets you view audio CD files as WAVs, then drag-and-drop them anywhere for one-stop duplication.



Plextor's Plexwriter 8/2/20 bundles a bonanza of software titles.

Also included is the handy Plextor *CD Res-Q*, which lets you make a backup of your hard drive onto a blank media disk. When D-Day (Disk-death Day) arrives—and you know it will—*CD Res-Q* enables you to boot off of the disk you created and quickly restore your drive to its former glory.

In our speed tests, the Plexwriter performed admirably, though at 14.1x, it was eclipsed for fastest average drive rating by the 24x Teac. The Plexwriter tested slightly behind the other drives in minimum sequential reads and full stroke access times, but by only a hair.

Given that the Plextor software blew our skirts up, and that it's the most inexpensive drive in this roundup, we have no problem giving the Plexwriter 8/2/20 mad props.

THE SPECS

MODEL	Plexwriter 8/2/20
INTERNAL BUFFER SIZE	4MB
INTERFACE	Fast SCSI
SCSI CARD INCLUDED	Adaptec 2930
SUPPORT FOR OVER-BURNING	Yes
RECORDING METHODS	Disk-at-Once | Track-at-Once | Multisession | Variable & fixed packet writing

PLUSES
- Killer software
- Fast
- Very affordable

MINUSES
- Pokey rewrite speed

MAXIMUM PC VERDICT

Price $430 external kit, $370 internal kit
Company Plextor
Phone 888.675.3986
URL www.plextor.com

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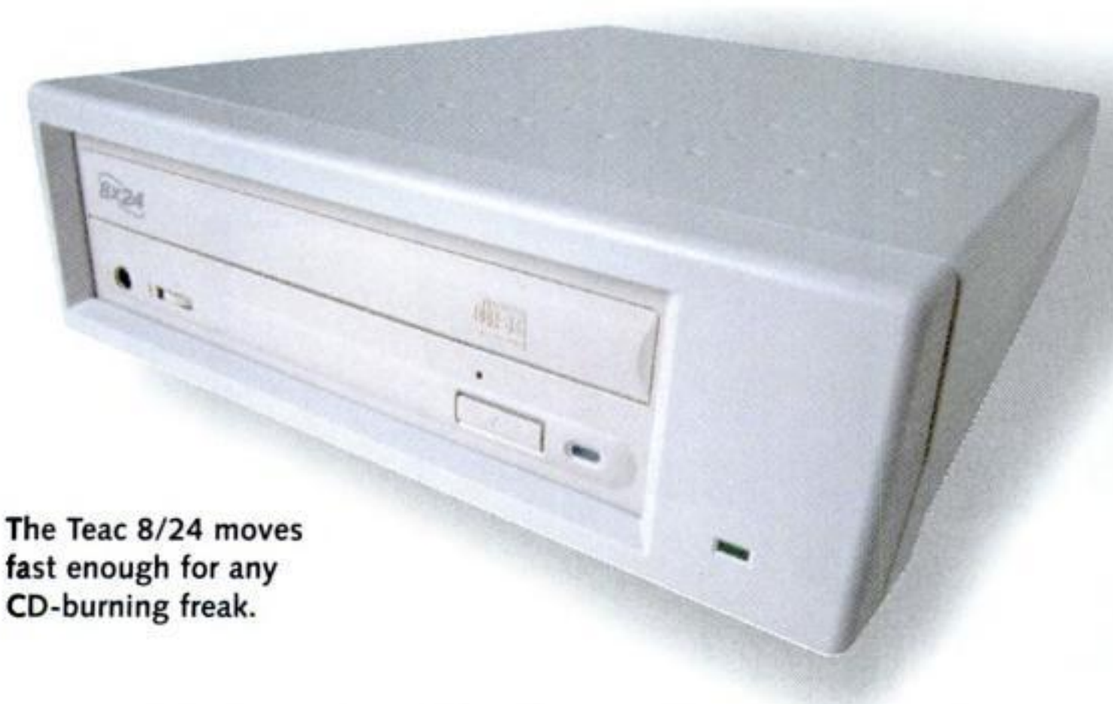
Teac 8/24 CD-R

The Ferrari of our roundup, the Teac is built to burn CDs fast. The bundle includes only the most basic CD mastering software, for simply copying data and audio files onto CDs, but that's not a bad thing, because this drive hauls ass.

Though it shares the same 8x recording capability as the other drives in this test, The Teac's 24x read speed gives it a major advantage over the other drives we reviewed, and helped put it on top in our CD-reading benchmarks.

It absolutely screamed in our audio extraction test, ripping an entire 365MB audio CD in a scant 4 minutes, 9 seconds, and pummeling the competition by more than a minute. It also performed exceptionally in sequential read tests, kicking sand in the other drives' faces with its 1.49MB/sec minimum read and 3.02MB/sec maximum read speeds. At the risk of pointing out the obvious, it also scored the highest drive rating of the group, at 15.1x.



The Teac 8/24 moves fast enough for any CD-burning freak.

As we mentioned before, the Teac's software package is either a blessing or a curse, depending on your intended use. It includes just the basics: Adaptec *Easy CD Creator*, *CD Copier*, and *Direct CD*. Though these titles are certainly our top choices for straight-up CD mastering—that is, simply copying files onto a CD—we'd also like to see at least one utility that's designed specifically for audio extraction and making MP3s.

Despite this, the Teac pretty much rocked our world. It's fast and dependable, and even without audio software, Adaptec's lineup is all any CD-burning freak could ever need.

THE SPECS

MODEL	Teac 8x24
INTERNAL BUFFER SIZE	4MB
INTERFACE	SCSI 2
SCSI CARD INCLUDED	Adaptec 2903
SUPPORT FOR OVER-BURNING	Yes
RECORDING METHODS	Disk-at-Once | Track-at-Once | Multisession | Incremental packet writing

PLUSES
- Very fast
- Rock solid drive that worked flawlessly

MINUSES
- Bare Bones software package

MAXIMUM PC VERDICT

Price $549 external, $449 internal
Company Teac
Phone 323.726.0303
URL www.teac.com

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Call **1-800-62-MEADE** for a free copy of Meade Telescope Catalog #174 or for a dealer location near you. ETX-90EC: $595, complete with 4-speed electronic hand controller (not shown). #497 Autostar Computer Controller: $149. Meade telescopes and accessories are available at over 3000 Meade dealer locations in the U.S.A. and Canada. **Meade Instruments Corp., 6001 Oak Canyon, Irvine, CA 92618. FAX: (949) 451-1460. *www.meade.com*** ©1999

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Discovery CHANNEL STORES — **1-800-938-0333**

THE NATURE COMPANY® — **1-800-367-6178**

RITZ CAMERA & 1 HOUR BIG PRINT — **1-800-52-FOCUS**

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Rainbow Six: Rogue Spear

CLEAR AND PRESENT WINNER

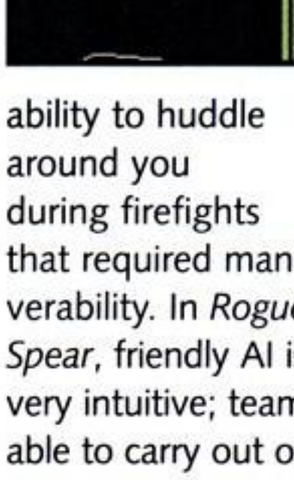
MAXIMUM PC KICK ASS! product

Half first-person-shooter and half tactical simulation, *Tom Clancy's Rainbow Six: Rogue Spear* is 100% Kick Ass, delivering 18 of the most nail-biting missions a civilian could ever experience.

As a sequel to *Rainbow Six*, last year's sleeper hit, *Rogue Spear* places you back at the helm of the ultra-secret anti-terrorist group codenamed Rainbow. Once again, your squad is called to locations around the world, ranging from the New York Metropolitan Museum of Art to a hijacked 747, to lay the smack down on terrorist forces.

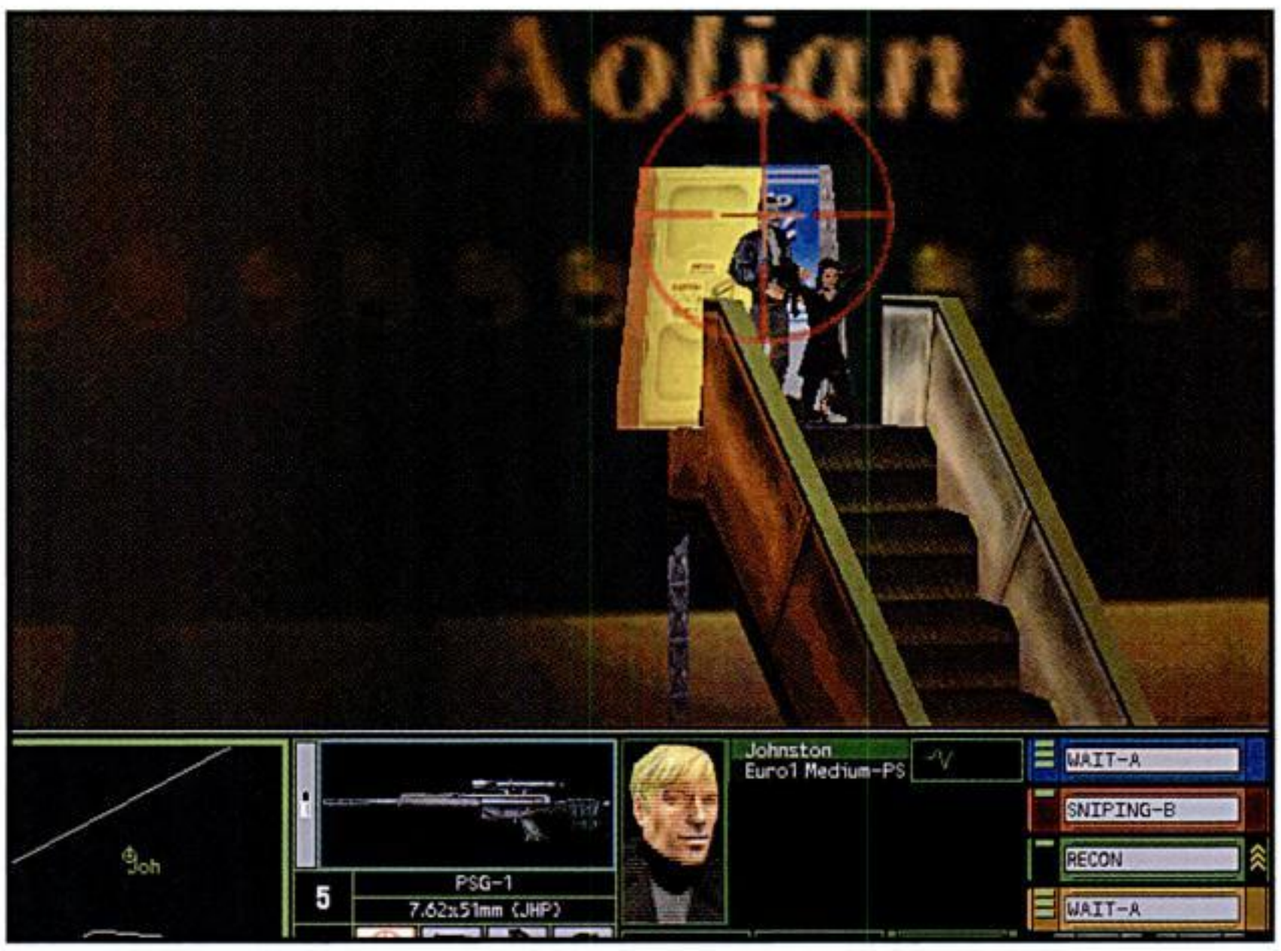
Missions begin in "tactical mode" where you select your team, equip them with weapons, and select waypoints for them to follow at your command. Planning assaults in the original game was difficult; the wire-frame models used to simulate hostile locations were tough to decipher. *Rogue Spear's* 3D modeler is a welcome improvement, rendering an accurate facsimile of the structures you'll be invading, instead of empty 3D blueprint space.

After planning a mission, you move into "action mode" and take control of your squad as it executes the tactical plan. This is where *Rogue Spear* really shows growth over its predecessor, incorporating a barrage of new weapons that operate as realistically in the game as their real-life counterparts do. Weapons emphasis is now on sniping, with four new rifles specifically designed for that purpose. It's a good thing, too, because we love taking off terrorists' heads from a thousand yards out—in the interest of national security, of course.



Please return your weapons to their upright and locked position in preparation for landing.

Thankfully, the teammate AI has been improved as well. The most nerve-wracking AI flaw of *Rainbow Six* was your teammates' uncanny ability to huddle around you during firefights that required maneuverability. In *Rogue Spear*, friendly AI is very intuitive; teammates are better able to carry out orders, and they stay put when told to. Unfortunately for you, the enemy AI also received the brainiac treatment. This time around, terrorists anticipate your team's movements and use flanking maneuvers. If you fire a shot at the bad guys and miss, they're likely to whack a few hostages and call for backup.



Rogue Spear's hostage situations are as real as it gets. Smile for the camera, scumbag.

Rogue Spear's graphics have also gotten a boost. Player models benefit from upped polygon counts, and an amazing weather engine beautifully renders raindrops, snowflakes, and even your teammates' breath in the cold. Sound effects and in-game music are well done despite the occasional stutter, effectively adding a dab of intensity to the already nerve-wracking missions.

Of course, team-based games are best played with friends, and *Rogue Spear's* two multiplayer options are awesome. Adversarial mode pits you against opponents in deathmatch, escort, and assassination scenarios, and in capture-the-flag variants. In Cooperative mode, you and your buddies tackle missions as a team, bringing you as close to true tactical work as you'll ever get without signing up and getting shipped to Paris Island.

On the downside, you'll need a big hard drive to hold all of Rogue Spear's 500MB, and LAN games sometimes crash for no reason. We also saw some funky texture seams where buildings connect to one another.

Still, as the perfect mix of cerebral planning and white-knuckled action, wrapped in an engrossing storyline, *Rogue Spear* is a title extremely deserving of our Kick Ass Award.

—Geoffrey Visgilio

PLUSES
- Meticulous attention to detail
- Emphasis on sniping
- Awesome LAN play

MINUSES
- LAN games sometimes crash
- Huge storage requirements
- White lines and texture seams

THE SPECS

3D HARDWARE SUPPORT
OpenGL

3D SOUND SUPPORT
DirectX-compatible sound

MULTIPLAYER
TCP/IP | LAN

TOTAL PLAYERS
16

MAXIMUM PC VERDICT

Price $50
Company Red Storm Entertainment
Phone 800.863.3550
URL www.redstorm.com

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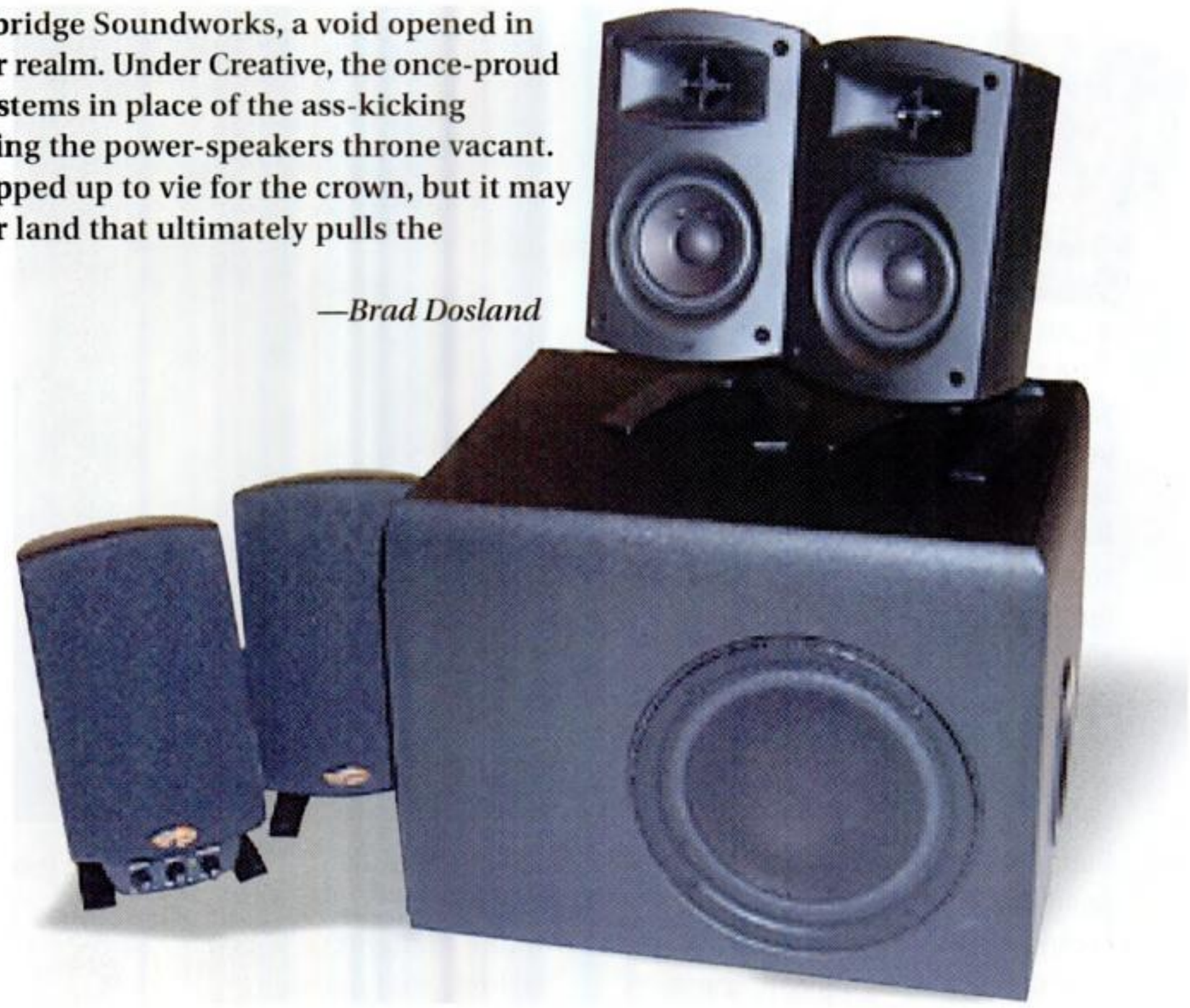
Hear and Now

NEW SPEAKERS BECKON A FRESH STATE-OF-THE-ART

After Creative Labs purchased Cambridge Soundworks, a void opened in the multimedia performance speaker realm. Under Creative, the once-proud Cambridge began releasing value systems in place of the ass-kicking systems it was once known for, leaving the power-speakers throne vacant. A pair of mighty contenders has stepped up to vie for the crown, but it may be a skinny newcomer from another land that ultimately pulls the sword from the stone.

—Brad Dosland



Klipsch ProMedia v.2-400

MAXIMUM PC KICK ASS! product

If you give a damn about sound, meet your new speakers. The Klipsch ProMedia v.2-400 system is far and away the best we've ever heard.

The four 60-watt, two-way satellites are perfectly matched with a burly 160-watt subwoofer that drops the bomb on all other subs. Quality construction couples with outstanding design to brilliantly deliver everything from the latest first-person shooter to the musical gamut, from classical to house. The capable sats even mastered our daunting Chopin passage test, which left other speakers crackling with distortion.

PLUSES
- The best speakers ever
- Four two-way satellites
- Kick Ass sub woofer
- THX support
- Mega-wattage

MINUSES
- Y adapter not included
- Exposes bad recordings
- Neighbors won't like them

Each sat is made up of a 3/4-inch dome tweeter and a MicroTractrix Horn with a 3-inch midbass throw, in a sturdy urethane shell. Their sound is rich, but lacks some sparkle compared to the other systems in this round up. The lead sat houses knobs for separate volume, sub volume, and surround (which acts as a fader, not a cheesy effect).

The system's sub is really the star of the show. The bass-reflex design mates a front port with a pair of side-firing 6 1/2-inch drivers, and delivers the most defined bass we've heard since Cambridge's PSW1 dedicated sub—which cost more than this entire system—rocked the Lab.

This sort of extreme subwoofer changes the entire audio experience. We rarely cranked the sub volume control on the lead sat past the halfway mark, but even with wattage to spare, the ProMedia's sub delivers kidney-crunching volume. This sub isn't just a blow-hard, though; the side-firing drivers create a bass sound with extreme definition and an absolutely seamless crossover. The twang of a bass string is reproduced in its entirety, from attack to decay. If you've never heard a really great subwoofer, it's nearly impossible to explain how important this is, but be forewarned: Once you've been exposed, it's nearly impossible to go back to the weak offerings that most rigs come with.

If you've got ears, you'll want the Klipsch ProMedia speakers.

The speakers' dual cables can be run to either a soundcard with dual output jacks, or fed through a Y adapter to cover all channels from a single out jack. Unfortunately, this adapter isn't included in the box. Ample speaker cabling is included, however, and a hefty preamp cable feeds power to the system.

Games are almost too immersive when experienced through the Pro Media speakers, with bomb blasts so real you'll be checking your booty for shrapnel. DVD movies are reproduced, thanks largely to the full THX implementation, with startling clarity. When a window breaks onscreen, you'll swear you're hearing the tinkle of glass around you. And music... ah, music. Listening to all our favorite tracks was like hearing them again for the first time. Nuances missed in previous speaker setups suddenly came to life, making us want to re-explore the deepest archives as our music collection so we could hear everything on the Klipsch. The one drawback is that the additional clarity also spotlights defects in recordings, and we found MP3s ripped from vinyl exposed as the pretenders they are.

Combining raw power with incredible responsiveness, especially from the genius subwoofer, Klipsch has earned both the Rookie of the Year and Most Valuable Player awards in a single deft play.

MAXIMUM PC VERDICT

Price $250
Company Klipsch
Phone 888.554.5665
URL www.klipsch.com

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DeskTop Theater 5.1 DTT2500 Digital

Since the original Cambridge SoundWorks multimedia speakers blew our minds and eardrums, Cambridge has defined state-of-the-art. Unfortunately, the DeskTop Theater 5.1 DTT2500 does not live up to that heritage.

Don't get us wrong: These are solid speakers with no glaring blemishes, but you can do better for the bucks—much better. Start with the Klipsch system on the facing page. Hell, just go back to the original SoundWorks setup for better-sounding sats and a sub that'll open up a can of whup-ass on almost any enclosure in town.

The DeskTop Theater sub sports a 5 1/4-inch throw in a ported design, delivering response that's rich and solid down to 50Hz. But the lack of dual drivers—such as those in the Klipsch—results in a perceptibly muddier low-end response.

Five lightweight satellites with 2 1/2-inch throws round out the system, with sound that's crisp, bright, and full of detail. But small size and thin plastic shells prohibit the sats from delivering much in the way of rich low-end response, creating an audible gap in the crossover from the throaty sub. The addition of the fifth speaker for a center channel has a negligible effect on the setup as a whole; placing the front speakers so that they're directly flanking your display is only important if you plan to spread out the surround speakers. The set also comes with a bulky breakout box that houses a slew of controls, but only narrow margins of the available settings make for decent listening.

The pride and joy of the DTT2500 is its Dolby decoding and digital-signal compatibility. True Dolby Digital 5.1 sound really rocks, and when these speakers are combined with a Creative Labs Live! soundcard with digital outs, the result is very clear tones.

Creative's DeskTop Theater offers an odd brew of power and control.

In spite of this, the DeskTop Theater simply sports a pricetag and history it cannot live up to.

PLUSES
- Powerful sub
- Breakout box with controls aplenty
- Digital input
- Auto corrects for lack of rear channel output

MINUSES
- Sloppy sub response
- Gap in crossover
- Lack of mid-range in sats
- Center channel ineffectual in most setups

MAXIMUM PC VERDICT

Price $299
Company Cambridge SoundWorks/Creative Labs
Phone 800.367.4434
URL www.americas.creative.com/speakers

6

Monsoon MH-500

At first glance, the latest flat speaker offering from car audio veteran Monsoon seems out of place in this roundup. The MH-500s cost a third the price of the other systems, they use planar focus flat design technology instead of traditional cones and horns, and they only offer front stereo speakers. They also come with a modest subwoofer, to say the least—yet they still manage to impress.

The system's innovative design includes 2 1/2-inch cones built into the bottom of the dipole-radiating planar magnetic flat speakers. The result is maximum sparkle, a unique broad soundstage, and a seamless crossover that makes the whole system sound bigger than it is.

In reality, the modest 8.5-watt sats aren't as loud as they are full, and the lil' 17-watt woofer must be cranked to the max to equal the sats, petering out in the ballpark of 60Hz. In our opinion, the more macho sub that ships with Monsoon's high-end MM-1000 series of flat speakers would have made this system much more interesting.

Perhaps the most problematic aspect of the MH-500 system is its controls. There's a puck with a flimsy volume dial and massive mute button, and the sub's volume knob is hidden under the sub itself. Yuck.

Nonetheless, dollar for dollar, there may not be a better deal in multimedia speakers today.

Don't let their size fool ya; these lightweights pack a punch.

PLUSES
- Full-range sound
- Innovative design
- Irresistible price

MINUSES
- Modest subwoofer
- Crappy controls

MAXIMUM PC VERDICT

Price $99
Company Monsoon
Phone 877.722.8346
URL www.monsoonpower.com

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Shadow Company

NOT MUCH PLOT, BUT PLENTY O' KILLING

We've been hankerin' for a high-powered, realtime tactical combat simulation, and *Shadow Company: Left for Dead* served up enough action, adventure, and anarchy to satisfy our craving.

THE SPECS

3D HARDWARE SUPPORT
Direct3D

3D SOUND SUPPORT
DirectSound

MULTIPLAYER
Internet | LAN | Modem | Serial

TOTAL PLAYERS
8

PLUSES
Beautiful graphics
Smart AI
Comprehensive manual

MINUSES
Weak plot
Imprecise camera controls

Shadow Company is a third-person sim that puts you in the shoes of a hired mercenary working for a mysterious company named "Granite." Your job is to rebuild a unit of soldiers "left for dead" after a surprise ambush in a remote part of Africa. The story begins with you attempting to move the troops to a secure location where the unit can be rebuilt. Along the way, you learn the reason why your crew was abandoned, and eventually seek revenge on the bastards that left your men to die in the jungle.

Shadow Company gives you control of up to eight different mercenaries, each with his own strengths, weaknesses, and personality. The AI is script-based, so all characters display unique traits, abilities, and even reactions to events and other characters. From the very beginning of the first conflict, you control every aspect of the story, from recruiting members for your squad and allocating resources, to molding the team into a lean, mean fighting force.

It's easy to control your mercenaries, because they respond intuitively to keyboard commands. Inventory items are maintained via drag-and-drop, so you can pick items up, drop them, and select targets. The third-person perspective gives you a front-row seat for all the action, courtesy of an in-game camera that's controlled by the mouse. We use the term "control" loosely, though—most of the time, the camera actually seems to be out of control. We found the camera-control setup totally awkward: The mouse scrollwheel controls zooming, and keypad buttons control the camera's rotation. We were never able to get the camera to move the way we wanted it to, and in the heat of battle, we had trouble selecting our desired viewpoint.

Shadow Company puts you in command of an elite mercenary unit that shoots first and asks questions later.

If you *do* get the camera movement down, you'll be in for a treat. *Shadow Company*'s graphics are some of the best we've ever seen in a third-person sim. Thanks to its proprietary 3D engine developed by Sinister Games, the game's 32-bit textures are as realistic and visually exciting as anything available. Explosions are particle-based, adding some extra "oomph" that makes everything look realistic. The jungle landscapes are eerily similar to those found in 'Nam movies, including bombed-out tanks dotting the landscape and amazingly detailed trees swaying in the breeze.

Sinistar's 3D engine's got all the goodies, including particle effects for realistic explosions.

Shadow Company's rowdy multiplayer action lets you team up with seven other players over a LAN or the Internet, and take on the baddies as a voice-linked squad. Though we wished for the option of teaming up against other armies of real people à la *Starcraft*, co-op mode was a blast, and it ran smooth as silk on our K6-III 400 MHz with a Voodoo3 2000 videocard.

Icing on *Shadow Company*'s tasty cake was the extensive manual, which is drawn up like a soldier's autobiography. In addition to run-of-the-mill installation and gameplay instructions, the manual provides extensive information on the weapons, vehicles, equipment, and even the countries in which the missions take place. Throw in the included "top secret documents" and what was included as standard software documentation becomes a mini-novel.

If you're up for a little senseless violence and bloody warfare—and who isn't?— *Shadow Company* won't disappoint. Forget the plot, go in with both barrels blazing, and you'll have a blast.

—Joe DeRouen

MAXIMUM PC VERDICT

Price $40
Company Ubi Soft Entertainment
Phone 800.824.7638
URL www.ubisoft.com

8

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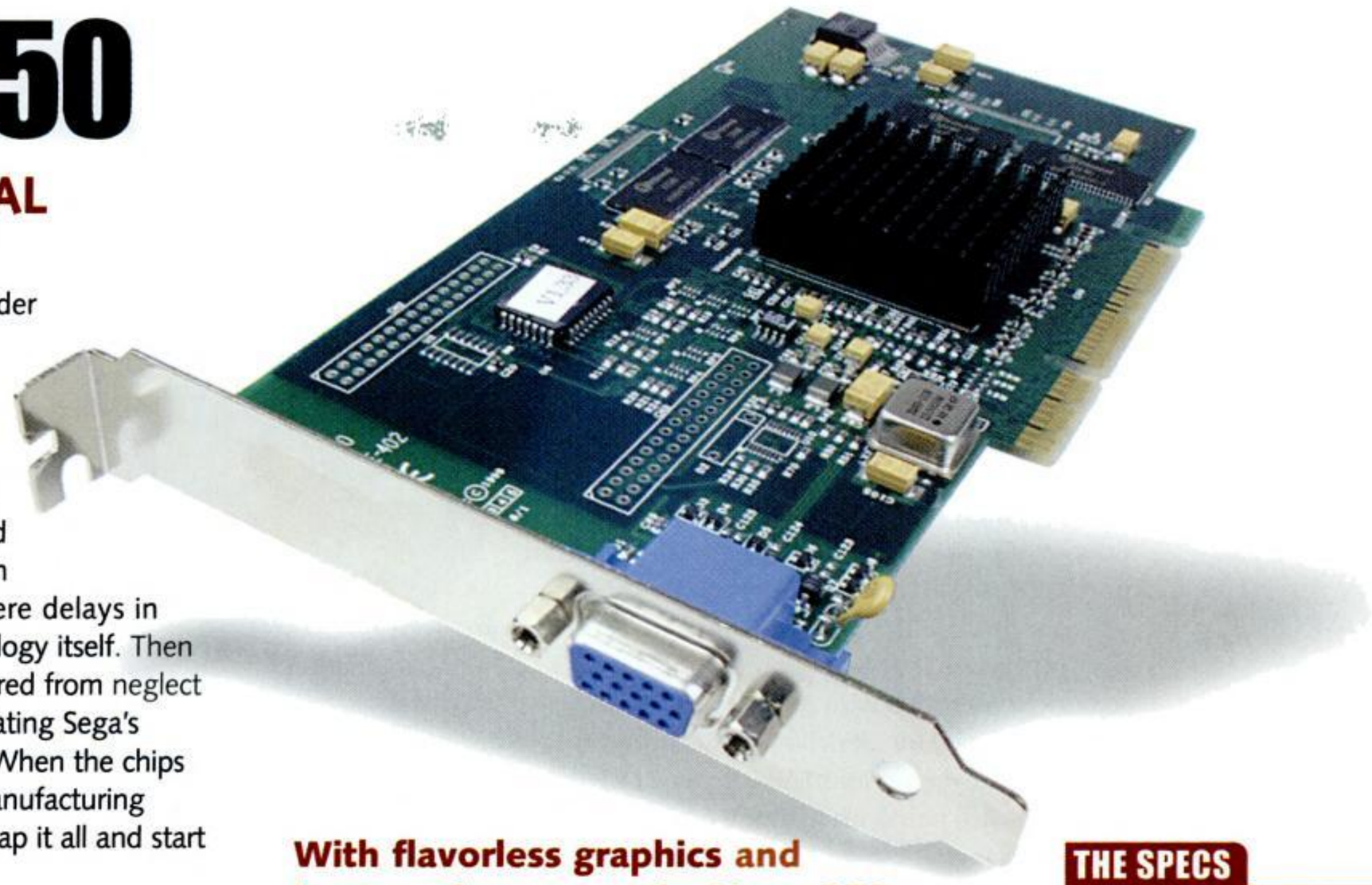
Neon 250

DEAD ON ARRIVAL



With flavorless graphics and inert performance, the Neon 250 lives up to its element name.

The Neon 250 is a big fat blunder in the shape of a videocard. Originally slated for release a year and a half ago, the Videologic PowerVR Series 2 graphics processor that powers the Neon 250 has been screwed up and delayed more often than Windows 2000. First there were delays in developing the Series 2 technology itself. Then the PC version of the chip suffered from neglect as Videologic focused on populating Sega's Dreamcast with Series 2 chips. When the chips finally went into production, manufacturing errors required Videologic to scrap it all and start all over again.

All this could be forgiven if the Neon 250 was worth the wait—but it isn't.

Visual defects abound in games run on the card, from textures popping in and out of place to butt-ugly mip-mapping. While we commend Videologic for putting so many Direct3D and OpenGL rendering tweaks in their drivers, we would have appreciated a card that made things look pretty out of the box. But the Neon 250 delivers ugly mip-mapping bands and a grotesque amount of detail errors across the board. Even turning on the advanced mip-mapping and filtering features couldn't solve these problems.

Many of these issues can simply be chalked up to PowerVR's different way of doing things: Tile-based rendering technology isn't quite what standard APIs, such as Direct3D or OpenGL, expect when shoving data down their graphics pipelines. They're used to dealing with vertex-based renderers, such as 3dfx's Voodoo^3 or nVidia's TNT2, which draw and texture-map all the triangles in a scene, then use the z-buffer to sort through and remove any triangles that won't be seen. The PowerVR architecture doesn't require a z-buffer to calculate depth in a 3D scene. Instead, it pre-processes each scene's geometry information so that it only has to render the foreground pixels—it doesn't render anything that would be obscured by a latter pass. PowerVR's tile-based rendering architecture is designed to render scenes of great complexity with nary a hiccup. The scene is broken up into tiles, which are independently processed and sent through the rendering process. This not only saves on frame buffer memory, but also helps maintain performance even as scene complexity increases.

In the closed-box world of the Dreamcast, the PowerVR Series 2 can really strut its stuff, because games are written to support PowerVR and PowerVR alone. But on the PC side, games are written to support multiple rendering architectures through standard APIs, so on the Neon 250, they look bad and play worse. The card's performance just isn't on par with the current generation of cards, lagging behind the TNT2 Ultra and Voodoo^3 in our two Direct3D timedemos and our *Quake II* benchmark. It did manage to outscore the Voodoo^3 3500TV in *Half-Life*, but the lack of a full PowerVR OpenGL ICD simply leaves a bad taste in our mouths, since it limits the card to games only. And tucking miniGL files into game directories is *so* last year.

The Neon 250 just doesn't have the muscle on advanced feature set to compete with the big boys.

—Sean Downey

THE SPECS

CLOCK SPEED	125MHz bus/125MHz memory
RAMDAC	250MHz
AGP SUPPORT	AGP 2x (also available as PCI board)
LOCAL MEMORY	32MB SDRAM
MAX 32-BIT RES	1600x1200
MAX 16-BIT RES	1920x1440
MAX 1600X1200 REFRESH RATE	60MHz
BUNDLE	Win9x drivers I E-Color *Colorific* and *3Deep*

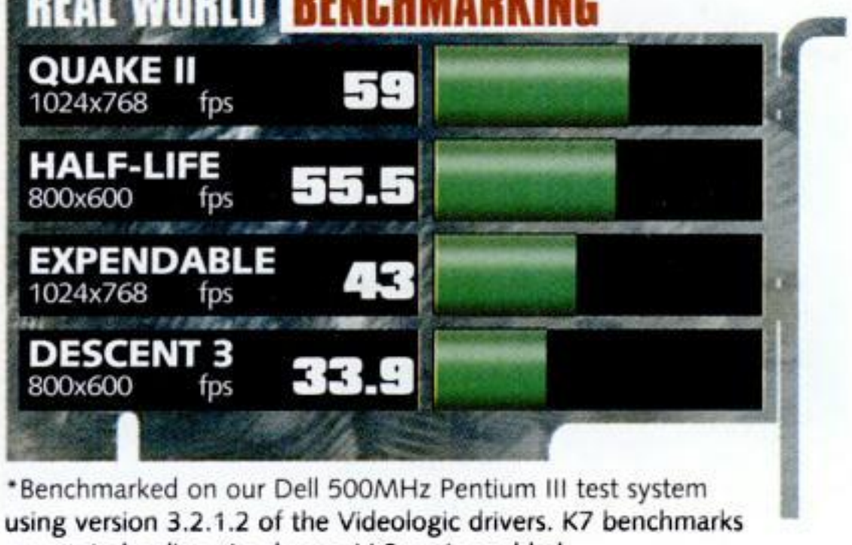
PLUSES

- Innovative tile-based rendering

MINUSES

- Non-standard rendering architecture yields poor image quality
- No OpenGL ICD
- Poor DVD playback
- Below average performance

REAL WORLD BENCHMARKING



*Benchmarked on our Dell 500MHz Pentium III test system using version 3.2.1.2 of the Videologic drivers. K7 benchmarks are posted online. As always, V-Sync is enabled.

MAXIMUM PC VERDICT

Price $170
Company Imagination Technologies (Videologic)
Phone 888.336.1198
URL www.videologic.com

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

Copyrighted material

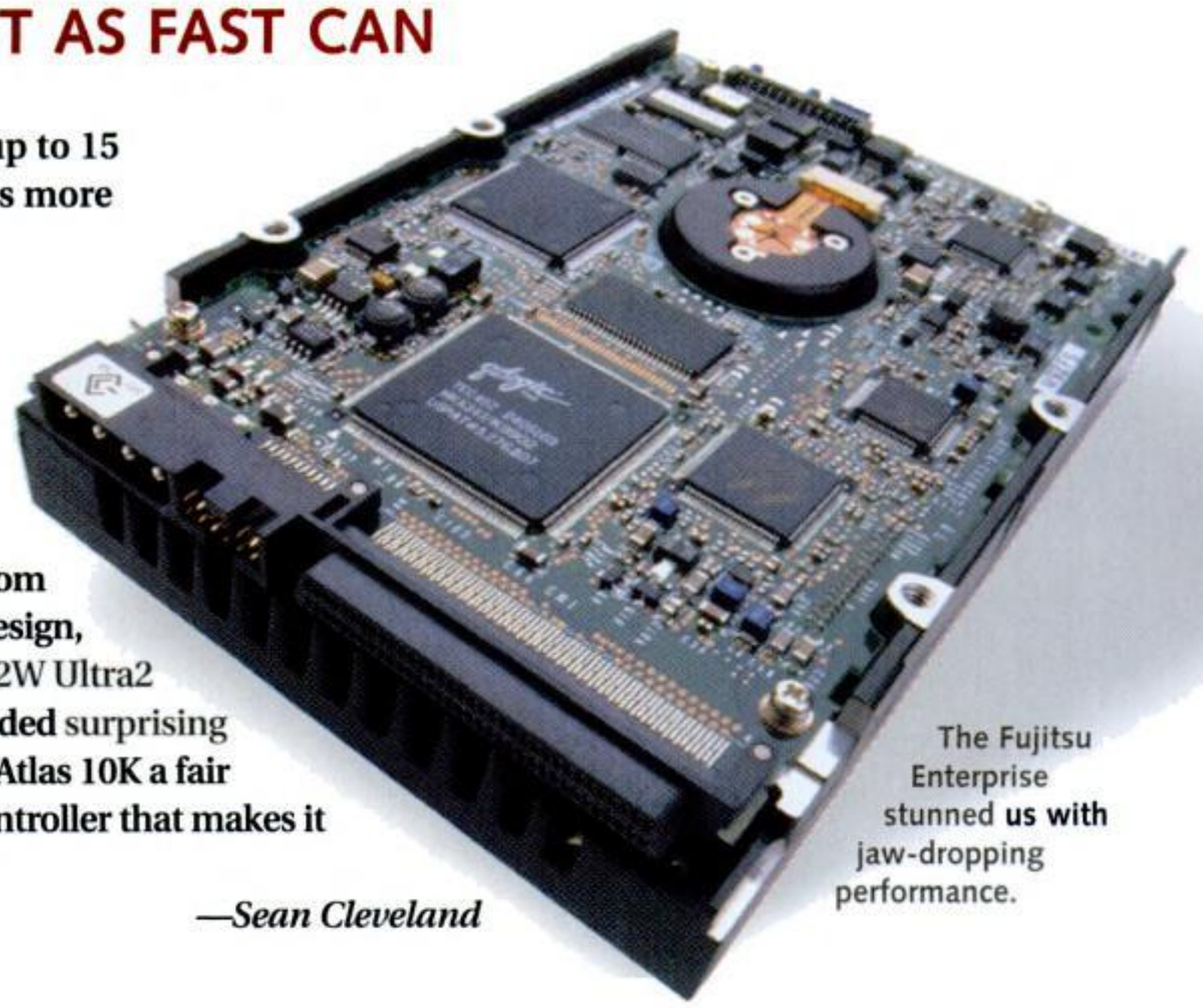
Ultra2 SCSI Hard Drives

FEATURE-PACKED AND FAST AS FAST CAN

Why SCSI, you ask? Because you can connect up to 15 devices on a single channel, and because SCSI's more intelligent interface gives you such features as disconnect/reconnect, synchronus/asynchronus communication, and error checking.

Though they share strikingly similar specs, the three high-performance Ultra 2 SCSI hard drives we looked at here boast radically different innovations. We'd hoped to include Quantum's newest Atlas 10K drive, but the unit we received from Quantum was of next-generation Ultra160 SCSI design, so benchmarking it with Adaptec's current 2940U2W Ultra2 controller (used for all drives in this roundup) yielded surprising performance degradation. We decided to give the Atlas 10K a fair shake, so we'll pair it up with the next Ultra160 controller that makes it to the Lab.

—Sean Cleveland



The Fujitsu Enterprise stunned us with jaw-dropping performance.

Fujitsu Enterprise MAG3182LP

MAXIMUM PC KICK ASS! product

Most people who have the need for speed in their hard drives center their attention on the offerings of IBM, Seagate, and Quantum—but aficionados know that Fujitsu drives are also speed demons. The Enterprise is no exception. When put through our paces, the Enterprise MAG3182LP dominated our benchmarks in almost every category.

The Fujitsu's average write speeds were 2MB/sec faster than the pack reviewed here; read speeds that were 3MB/sec superior made the other drives look positively geriatric. Not only is the drive fast across the platters, it's also quick on the data uptake, clearly beating out the others in random access tests and read burst tests that measure cache bursts across the bus. Even in our high-end Intel Iometer benchmarks (used by almost every manufacturer's R&D teams), the Enterprise layed down smack-o-plenty, leaving the other drives to battle over second place.

After witnessing such a decisive victory, we had to know what makes this drive tick. Like the other drives here, the MAG3182LP uses IBM's Giant Magneto-Resistive (GMR) head technology to pack 3.6GB of data onto each of their five 3.0-inch diameter discs. The only info we could find on GMR told us that the dual-processor design is supposed to improve response time in high-load applications. For the most part, these claims seemed to hold true; the drive stayed close to the 30MB/sec range throughout benchmarking, showing mostly consistent reads across the platter.

Note that we said *mostly* consistent. The Enterprise didn't receive a perfect 10 verdict because of the number of low spikes and data drops that reached down in the 25MB/sec range, which probably reduced the average read speed by a whole 1MB/sec. But, the Enterprise's low points were still higher than those of the other drives we looked at, and its write speeds were very consistent.

Fujitsu isn't known for its strong retail presence, so the Enterprise may be hard to find. But if you're looking for a smokin' fast SCSI drive, it's more than worth your time to track it down.

PLUSES
- Fastest overall drive in almost every test
- Consistent write speeds across platter

MINUSES
- Read speeds occasionally drop across platter

MAXIMUM PC VERDICT

Price $600
Company Fujitsu
Phone 877.982.1990
URL www.buyfcpa.com

9

THE SPECS

MANUFACTURER	FUJITSU 18GB	IBM 18GB	SEAGATE 18GB
Drive Name	Enterprise	Ultrastar 18LZX	Cheetah 18LP
Drive Model	MAG3182LP	18LZX	ST318203LW
Interface	Ultra2 SCSI LVD	Ultra2 SCSI LVD	Ultra2 SCSI LVD
Form factor/Weight (inch/kg)	3.5-inch	3.5-inch	3.5-inch
Weight (lbs)	1.54	1.54	1.5
Buffer size (MB)	2MB	2MB	1MB
Number of discs/heads	5/10	5/10	6/12
Gigabytes per platter (GB)	3.6	3.67	3.03
Areal density (Gbits/square inch)	3.71	3.5	3.17
Rotational (spindle) speed (RPM)	10,025	10,000	10,016
Advertised average read seek time (ms)	5.2	4.9	5.2
Advertised average latency (ms)	5.2	4.9	3.0

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

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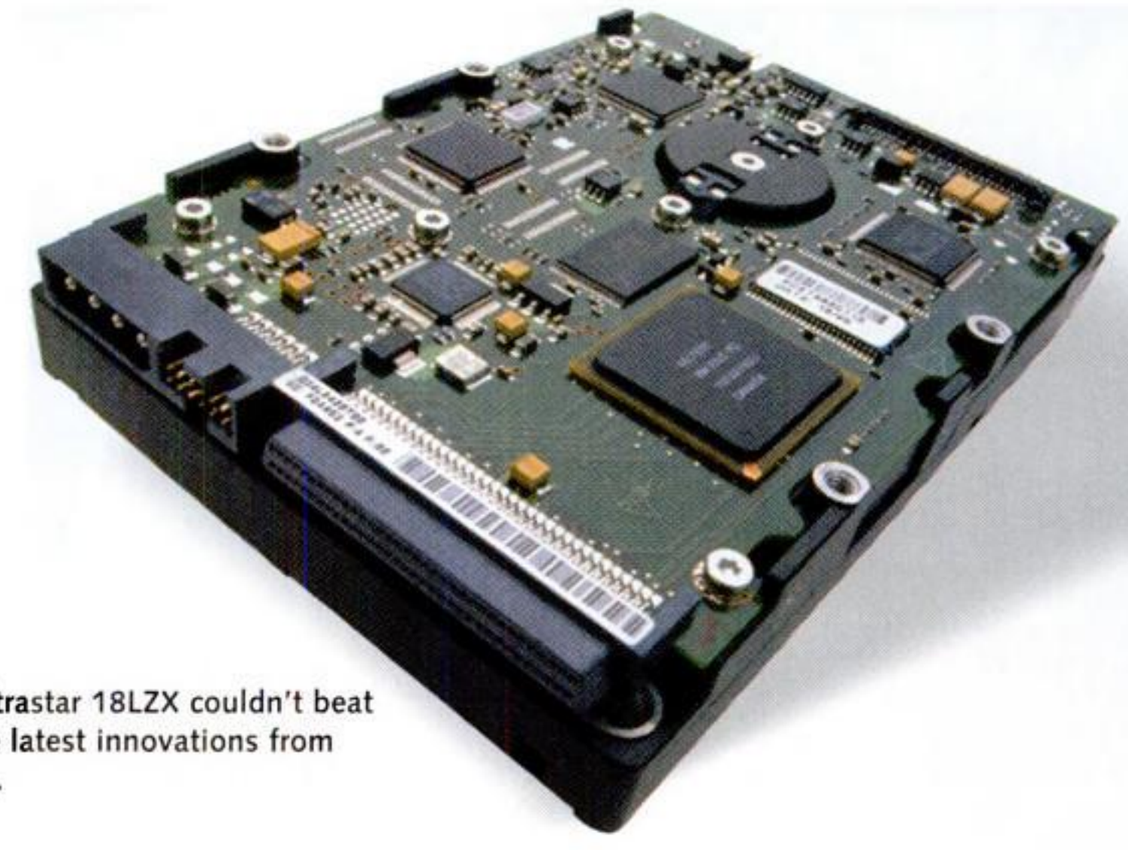
IBM UltraStar 18LZX

IBM's third-gen offering in the UltraStar line includes advanced GMR head technology and glass substrate disks that result in increased strength and uniformity. But, somehow, these new features don't put the UltraStar's performance past run-of-the-mill.

Sure, GMR head technology begets increased areal density and yields drive-performance gains that are clearly apparent. But, the UltraStar 18LZX isn't any faster than Seagate's Cheetah, and it paled next to Fujitsu's Enterprise. The UltraStar bested the Cheetah in a test of random access times, but turned in slower read burst speeds. And the drive virtually collapsed during the Intel Iometer I/O rate test, falling behind the other drives here by upwards of 38%. Its real-world benchmark scores were also the lowest of the three.

In spite of this and the fact that the drive occasionally emitted a high-pitched squeal during long, sequential reads—though that will probably go undetected when the drive is insulated within an enclosed case—the Ultrastar was otherwise solid. Perhaps it will outlast and even outperform the others in the long run, but it's hard to say. Unlike IBM's second-gen UltraStar, the 9LZX, the 18LZX doesn't deserve a Kick Ass.



The Ultrastar 18LZX couldn't beat out the latest innovations from Fujitsu.

PLUSES
- New glass substrate adds disk integrity
- Solid construction and performance
- Consistent read/write speeds across the platter

MINUSES
- Among the lowest overall benchmark scores

MAXIMUM PC VERDICT

Price $600
Company IBM
Phone 888.426.2255
URL www.storage.ibm.com

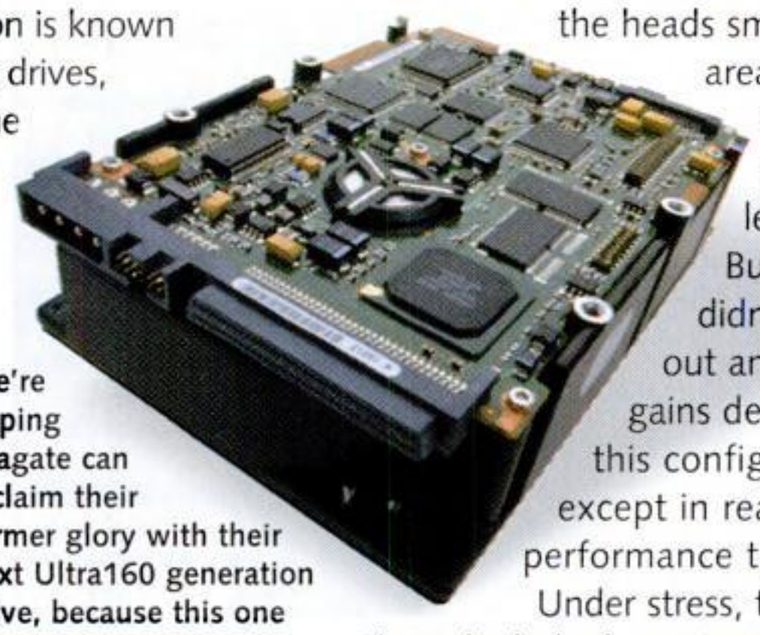
7

Seagate Cheetah 18LP

Seagate's SCSI division is known for pumping out fast drives, and innovations in the venerable Cheetah line certainly differentiate those drives from the rest of the pack. But, Seagate's new Cheetah failed to establish itself as a contender in benchmark comparisons.

The Cheetah uses six platters instead of five, and 12 read heads instead of the standard 10, giving the heads smaller read areas, faster throughput, and less drag. But our tests didn't ferret out any clear gains derived from this configuration, except in real-world performance tests. Under stress, the Cheetah choked, posting the fastest fall-off in both read and write speeds across the platter. Downward read spikes dropped sporadically by up to 6MB at a time, so we'd think that the Cheetah is a particularly poor choice for video work, where each falloff equals a dropped frame.

The Cheetah 18LP was once as fast as it's real-life counterpart, swooping across the African plains and snatching up data faster than you can say "nice kitty." Apparently, it's gotten fat in the off-season.



We're hoping Seagate can reclaim their former glory with their next Ultra160 generation drive, because this one failed to impress.

PLUSES
- Very fast Windows NT performance

MINUSES
- Worst read/write speeds across platter
- Noisiest of all the drives

MAXIMUM PC VERDICT

Price $670
Company Seagate
Phone 877.271.3285
URL www.seagate.com

6

DARE TO COMPARE

MANUFACTURER	FUJITSU 18GB		IBM 18GB		SEAGATE CHEETAH 18GB	
HI TACH BENCHMARKS	Win98	WinNT	Win98	WinNT	Win98	WinNT
Average Read Speed (MB/sec)	25.3	25.3	22.3	22.3	22.5	22.4
Average Write Speed (MB/sec)	19.6	19.3	17.5	17.3	17.5	17.5
Random Access Time (ms) [1]	8.2	8.2	8.4	8.4	9	9.1
Read Burst Speed (MB/sec)	59.3	58.9	54.2	52.1	57.4	56.9
CPU Utilization (%)	3.7	2.7	3.1	2.0	3.5	2.2
INTEL IOMETER BENCHMARKS						
Random Access Test (tps) [2]	–	116.0	–	109.8	–	103.1
Max. Read Speed (MB/sec) [3]	–	28.6	–	26.4	–	26.4
Max Read I/O Rate (I/Ops) [4]	–	13669	–	8506	–	13194
REAL WORLD BENCHMARKS						
Time to boot OS (sec)	28.8	25.7	29.4	26.2	29.7	25.3
Time to copy 644MB (min:sec) [5]	2:19	2:36	2:39	2:38	2:43	2:27

All drive benchmarks performed on a Dell Dimension XPS T500 computer using an Adaptec 2940U2W Ultra2 SCSI controller with LVD cable and terminator.
[1] Not to be confused with seek time. Seek is the amount of time it takes to move the head to the proper requested track, whereas access time is the time it takes to seek and read data. [2] Performs 2K random reads (67%) and writes (33%) across the whole drive, which represents a typical database workload. Score reported is in Transactions Per Second (see Terminator). [3] Performs 64K sequential reads across the whole drive delivering a maximum throughput rate in MB per second.
[4] Determines maximum number of I/O's (Inputs/Outputs) per second by reading 512K blocks of data sequentially across the whole drive. Score reported in total number of I/Os per second. [5] The contents of MAXIMUM CD #15 were copied to the drive. The benchmark timed how long it took to copy the contents to another folder on the same drive.

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BS Rating:

BS ● ● ● ● ● ● ● ● ● ● Useful Content

www.maximumpc.com

MaximumPC.com:

Maximum Useful Content / Minimum BS

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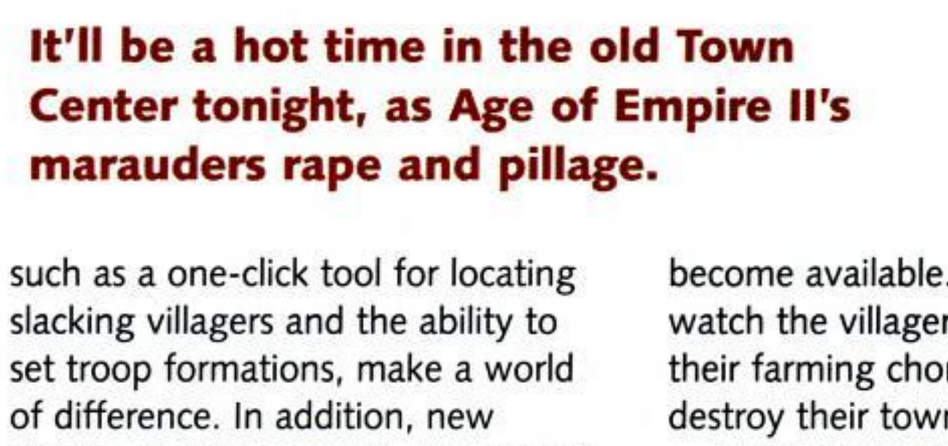
Age of Empires II

TOP OF THE EMPIRE STATE BUILDING

For those who fell head over heels for Bruce Shelley's original romp through social evolution, *Age of Empires II* will feel like déjà vu all over again. But even those who were turned off by the original's weak points, such as bad pathfinding and weak AI, will find something to get smitten over this time out.

Your goal is the same: Build your empire as you progress through various historical epochs, including the Dark Ages, the Feudal Age, the Castle Age, and the Imperial Age. But in *AoEII*, annihilation is no longer the only road to victory; a more sophisticated scheme allows you to ally yourself with other players through trade and cooperation, and to win based on the civilization you craft. Of course, sheer destruction is still much more gratifying.

Onscreen, the *Age of Empires II* world looks similar to that of the original: an isometric realm of 2D, sprite-based animations. Only minor cosmetic changes, such as bigger buildings, differentiate the new version from its predecessor. We'd have enjoyed seeing the game engine evolve into something 3D, adding the ability to rotate and zoom, but for now, the most obvious improvement is the game's interface. While still an intuitive point-and-click affair, added options have seriously deepened the gameplay. Simple additions, such as a one-click tool for locating slacking villagers and the ability to set troop formations, make a world of difference. In addition, new orders—including a seek-and-destroy command and smarter defensive units that return to their original position after battle—arm you with some of the control you lacked in the original. Pathfinding is also radically improved; you no longer need to worry that your dullard villagers will get stuck in the forest because they've lost their way home. The big exception to this is ships, which are still prone to clump and get locked up.



It'll be a hot time in the old Town Center tonight, as Age of Empire II's marauders rape and pillage.

AoE II's dim-witted war ships take out their anger on a peaceful university.

Age of Empires II's enemy AI is still a mixed bag. New formations make the enemy's offensive assaults absolutely devastating, but the computer's defensive posture is still disappointingly weak. Launch a few flaming balls of love at the enemy from your trebuchet, and he'll simply send random military units to deal with you as they become available. Fend them off, and watch the villagers casually perform their farming chores while you destroy their town center.

While the game feels strikingly similar to the original, the combination of compelling interface additions with new races, units, and technologies to be discovered ensures that *Age of Empires II* will re-ignite your fire to rule the world.

—Brad Dosland

PLUSES
- Better overall pathfinding
- Troop formation control
- New races and technologies
- Scenario editor
- Excellent character/building animations

MINUSES
- Not enough innovation
- Same old 2D engine
- Bad pathfinding at sea

THE SPECS

3D CARD SUPPORT
None

MULTIPLAYER
MSN | TCP/IP | IPX | LAN | Modem | Serial

TOTAL PLAYERS
8

MAXIMUM PC VERDICT

Price $50
Company Microsoft
Developer Ensemble Studios
Phone 800.426.9400
URL www.microsoft.com/games

8

SIMCITY CLASSIC FOR PALM

Many gamers discovered the joys of running a civilization with the original city-building sim, *SimCity*. Now, the original game from Maxis has been officially ported to the Palm platform, in a surprisingly successful coup.

Everything's intact on the Palm's 160x160 monochrome screen, from the overhead view of your developing burg to your citizens' take on your job performance. It really is just like the original, except that it plays in the palm of your hand.

As with the original, be prepared for minutes to become hours as you guide your village into a bustling metropolis, fend off disasters (including an attack by everyone's favorite giant radioactive lizard), and jigger taxes at the eleventh hour to screw the citizens while protecting your public opinion. In fact, the secret money behind the relaunch of *SimCity* on the Palm platform may have been the shadowy figures behind the triple-A battery industry.

MAXIMUM PC VERDICT

Price $30
Company Atelier
Phone 800.656.5426
URL www.atelier.tm/palm/scc.html

9

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New PDAs flex their muscles

PALM IS NO LONGER THE ONLY GAME IN TOWN

From synchronizing contact data and appointments with your desktop, to reading daily news updates and e-novels, a whole lot is possible on a PDA. If you're tired of looking covetously at your friends' Palms, start looking at your options—Palm is no longer the only way to go. This month, we check out two contenders looking to knock Palm off the PDA throne.

—Kenn Durrence

Without USB, Cassiopeia can't **heed your need for speed.**

Cassiopeia E100

PLUSES
- Beautiful screen
- Stereo jack
- Rechargeable battery

MINUSES
- Should ship with multimedia package standard
- High price
- Bulky

THE SPECS

SCREEN RESOLUTION	240x320, 16-bit color
PROCESSOR	MIPS 131MHz RISC
RAM	16MB
DIMENSIONS	.78" x 3.26" x 5.11"
OTHER	Docking Station

Casio's Cassiopeia E100 comes with a powerful 131MHz processor and 16MB of RAM. With 16-bit color and a glistening 240x320 TFT-liquid crystal display, it's got the best screen we've ever seen on a PDA. Add to that the Cassiopeia's stereo output jack and its ability to play multimedia files, and you might think Casio had created the end all-be all of PDAs.

Not quite. The E100 can play MP3 files and AVI movies in clear stereo sound, but inclusion of a legacy serial port instead of a USB port seriously slows the process of importing files, hindering the PDA's performance. Of course, if you go with the bare-bones version of the Cassiopeia, you can forget multimedia software goodies altogether, unless you want to pony up another $69 to separately purchase a software package that includes a movie converter, a mobile audio player, and an image viewer.

The Cassiopeia's standard software package embodies Casio's "kitchen sink" strategy: Include enough of everything to please everyone. We liked *Casio Menu*, a Palm-like interface designed with program-launching "buttons," and the *Compact Flash* backup, which enables you to back up data on the fly. There's also *Audible*, for listening to audio books, and a web browser called *AvantGo*. Perhaps the handiest inclusion is the Palm conversion software, which allows you to convert a contacts database from a Palm device to the Cassiopeia's Windows CE environment.

Cassiopeia's amazing screen and laundry list of features make for a nice device, but its lack of a fast USB hookup tells us that this handheld PC isn't ready for prime time.

MAXIMUM PC VERDICT

Price $500
Company Casio
Phone 800.962.2746
URL www.casio.com

8

Visor Deluxe

PLUSES
- Affordable price
- Springboard expansion slot is very useful

MINUSES
- Not enough units to meet demand

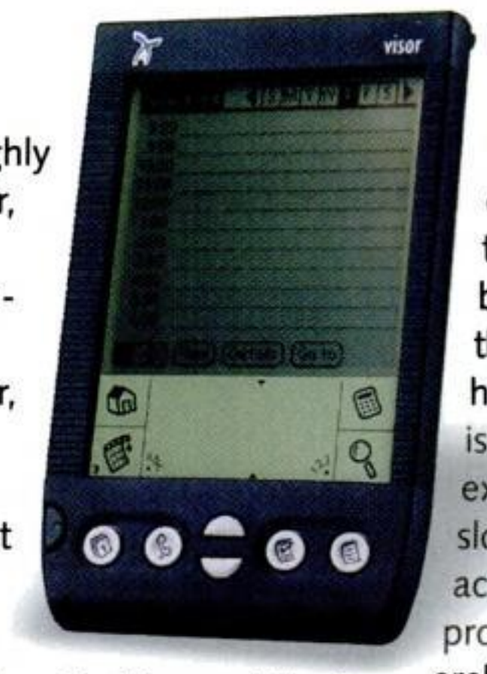
THE SPECS

SCREEN RESOLUTION	Backlit 160x160 gray-scale
PROCESSOR	16MHz Motorola Dragonball
RAM	8MB
DIMENSIONS	4.8" x 3.0" x .7"
OTHER	Docking Station

MAXIMUM PC KICK-ASS! product

Handspring's highly anticipated Visor, the first Palm clone and brainchild of the Palm's inventor, has finally made its way into the Lab. We're happy to report that it kicks mucho derriere.

Visor's best feature is its use of the familiar Palm OS. It's also the first PDA to sport some color, though it's too bad the new hues didn't creep from the plastic casing into the display, where we'd have enjoyed seeing it even more. Still, Visor is available in five different shells: blue, graphite, green, ice, and orange.



The Visor could beat Palm at its own game.

In addition to the ample 8MB of RAM provided to tackle your busy schedule, the Visor's handiest feature is its Springboard external expansion slot, which can accept a slew of proprietary peripherals including a pager, a modem, a GPS receiver, video game cartridges, or even an MP3 player card. The Visor also includes a USB connector, so it imports files from your desktop at blazing-fast speeds.

Visor's price is just right; the deluxe version includes 8MB of memory and a cradle for $249, and the bare-bones unit has 2MB of memory and no cradle for $149. With such a low price tag, you'd think Handspring would have cut corners on the Visor's construction, but the unit feels solid enough to survive the rigors of travel, although it appears to be less sturdy than a Palm device.

With its sweet price and even sweeter features, the Visor is, dollar for dollar, one of the best PDAs we've ever seen. As far as we're concerned, it just about beats the Palm at its own game. The only catch? Demand is far exceeding supply, so finding one on store shelves is akin to spotting a unicorn.

MAXIMUM PC VERDICT

Price $250
Company Handspring
Phone 650.230.5000
URL www.handspring.com

9

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Painter 6.0

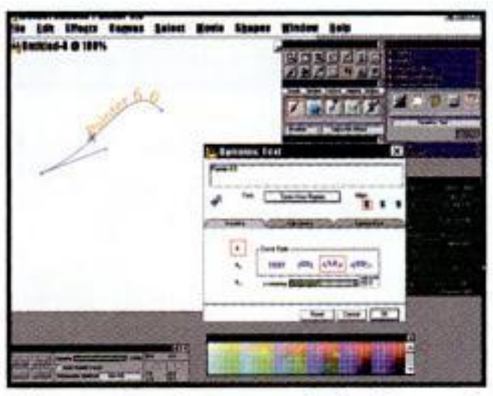
UPDATED PRESENTATION OF A FAMILIAR DISH

MetaCreations' latest rev of *Painter*—a "natural media" drawing tool in which your brushes, paints, and drawing surfaces all interact with one another as they would in real life—includes some handy new features that streamline the artistic process. As for claims that the program has been overhauled? Well, not quite. But *Painter* is still one of the coolest drawing apps around.

If you've used *Painter* before, you'll probably be struck first by the redesigned user interface—it's now much less cluttered. Palettes can be collapsed into one-word listings, and after you close them, a small icon reminds you of their present setting so you can check it at a glance. Controls can also be "torn off" of an open palette and used to create a custom palette that contains the controls you use most frequently.

For *Painter* users, some of this may sound familiar—which it should, since most of the options outlined here are, in fact, nearly identical to those offered in *Painter* version 5.x. The most-hyped additions to version 6.0—"Industry Standard Layers" and "Imposto Painting Effects"—are rehashed options that can also be found in previous versions: Floaters are now called layers, and the Imposto effects available as plug-in floaters are, feature-for-feature, identical to those found in version 5.x.

Painter's Imposto palette knife shows relief effect and consistent color dispersion.



The new text on a path feature of Dynamic Text allows manipulation of text in real time by moving the Bezier handles.

We did find a few true additions, including a new brush-stroke technique that results in a continuous stream of color rather than on-and-off dabs. A new velocity buffer smoothes out strokes that previously suffered from a jerky, choppy look, and "brush loading" yields a great streaking effect created by stray bristles picking up the colors of still-wet paint on the canvas around them. In the past, a circular area defined the spray of the airbrush; now, information about its bearing and tilt can render an oval spray. Combining the circular and oval sprays as the stylus moves in realtime results in a subtle wide-to-narrow effect—a hallmark of really professional work. Another new airbrush effect, "Continuous Time Deposition," causes paint to thicken when a brush is held in place—a welcome, more intuitive alternative to the previous method of repeated clicking in order to create paint build-up.

Overall, *Painter 6.0* offers some nice new effects, and even its rehash of old ones is pretty palatable.

—Rick Stevens

PLUSES
- Unequaled natural media effects
- New, clean interface
- Familiar methods for experienced users

MINUSES
- Steep learning curve
- Upgrade is not very compelling

THE SPECS

IMPORTABLE FILE TYPES
RIF | TIF | CMYK TIF | PCT | PSD | BMP | PCX | TGA | GIF | JPG | FRM | PYR | MOV | AVI

EXPORTABLE FILE TYPES
AI | HTML IGIF | JPG | TIF | MOV | AVI

MAXIMUM PC VERDICT

Price $399 for full version, $149 for upgrade
Company MetaCreations
Phone 805.566.6200
URL www.metacreations.com

8

HOW TO USE IMPOSTO

- From the brush section, select "Imposto" and "Loaded Palette Knife."
- From the color section, pick a reddish violet for the foreground color and a violet blue for the background color.
- Create a stylized ribbon on a white canvas.

The Imposto loaded palette knife simulates depth.

- Open the gradient section and select "Orange Neon." Click on the dropdown menu in the gradient section and select "Express in image." Set the bias to 24%. Click on "OK."

Here's the finished image after the Orange Neon background has been imposed.

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Makin' Madness

PUT ON YOUR BOOGIE SHOES

Back in the day, you needed talent to become a famous musician. But in this, the post-Milli Vanilli era, computers do most of the work, helping you to create innovative new sounds, mix multiple tracks, and even read music for you. The software titles reviewed below can aid you in your quest to be the new Right Said Fred: MixMan's *StudioPro* puts the hip to your wannabe-club-DJ hop, Cakewalk's *GrooveMaker* pimps your funk soul brutha, and Musitek's *SmartScore* lends a helping hand to old-school musicians by converting sheet music into MIDI format. Next stop, the Grammy awards.

—Daevid Vincent

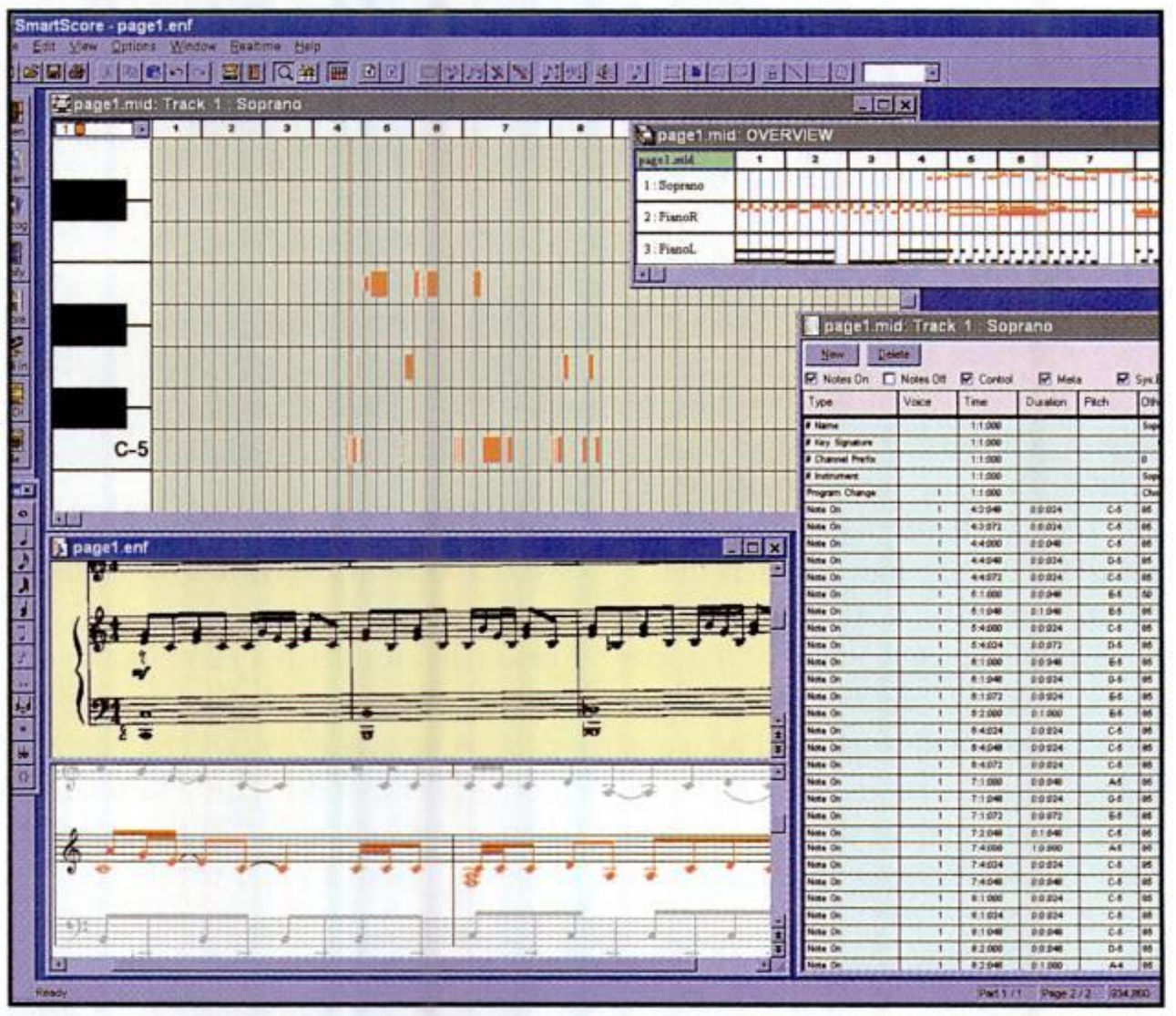
SmartScore

For the modern maestro, the ability to convert musical scores to a digital form is a necessity. Musitek's *SmartScore* gets that job done, but unfortunately, that's about all it does.

Using bleeding-edge OCR technology, SmartScore converts handwritten musical staves and notes into machine-readable MIDI events via a TWAIN-compatible scanner. The process is very straightforward: Place a single page of sheet music in the scanner, preview it and adjust contrast and white balance to ensure optimal recognition, and hit the scan key. *SmartScan* can be run in a mode that prompts you to feed in page after page, which is handy.

Once your score is scanned in, *SmartScore* lets you navigate and tweak it, but your viewing options are limited in their usefulness. We liked the Event List view best; it displays the notes in a variety of musical notations, such as measures, beats, or ticks. Unfortunately, the list doesn't scroll, making it difficult to follow along with the concurrent audio output and visually synchronize what you're hearing with the notes you're reading.

Navigation is also a pain, thanks to the program's busy layout.



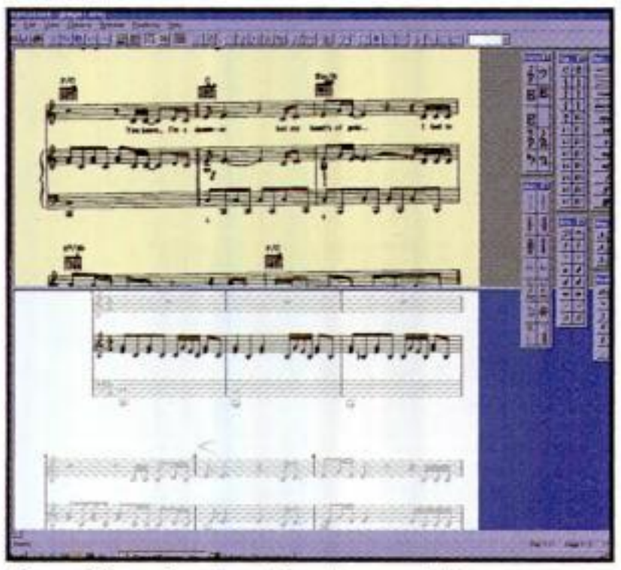
Some of SmartScore's views are too big, and some are too small, but none are just right.

PLUSES

- Easier than plotting by hand
- Fast recognition from standard TIFF files
- MIDI to notation and back again

MINUSES

- Doesn't always recognize music correctly
- Corrections required after scanning
- Palettes aren't dockable



SmartScore's nine floating palettes are about seven too many to control

Keeping track of the music you're working on is a serious chore, despite several features designed to alleviate confusion. Though *SmartScore* numbers each measure, the layout is so congested that it's tough to find your place in what looks like a musical note train-wreck. Also, the original source material and the converted version of the music are shown in two different windows, but the windows aren't always in synch. The OCR also ignores guitar chords and lyrics, limiting the program's usefulness.

SmartScore's most annoying attribute is its tendency to ignore portions of the piece you've fed into the scanner. We're not talking about Hendrix solos here—even simple arrangements sometimes pass through undetected. And, although you can edit individual MIDI notes, they aren't "snapped" into correct musical time, so you still need to do plenty of massaging in a real sequencer in order to clean your work up.

SmartScore leaves a lot to be desired, but if you're desperate to get an elusive piece of music into MIDI format and you don't have the patience to do it by hand, *SmartScore* is one of your only options.

MAXIMUM PC VERDICT

Price $400
Company Musitek.
Phone 805.646.8051
URL www.musitek.com

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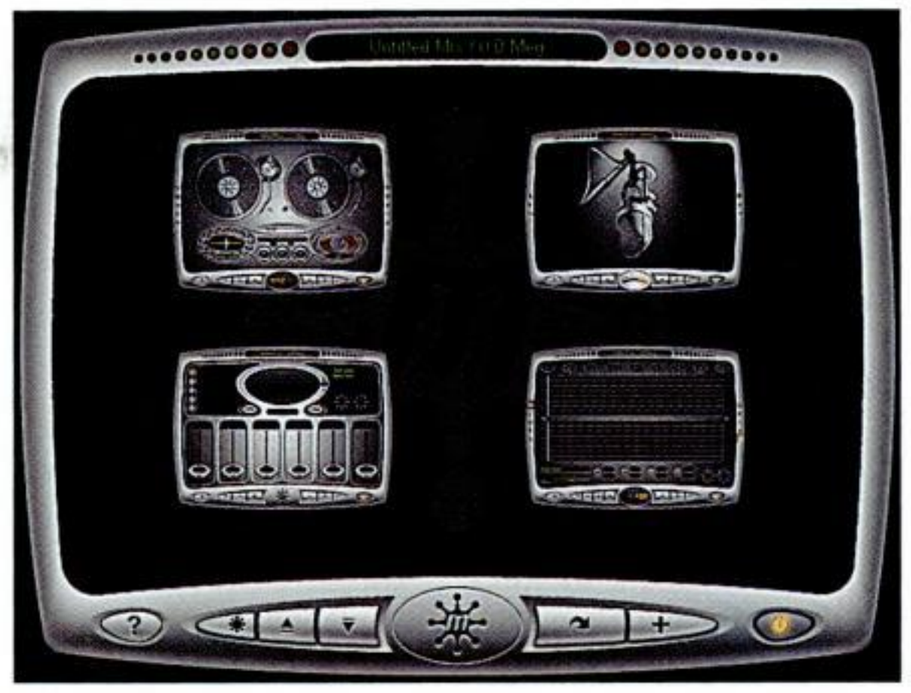
Studio Pro

Mixman's *Studio Pro* lets anyone create seemingly complex and dense pieces of music, without any schooling in music theory or MIDI creation. By incorporating an advanced technique known as beat matching, *Studio Pro* ensures that each audio track is synchronized in tempo and in key with the other tracks in a piece.

Studio Pro's package is comprised of four "studios," each of which provides you with different recording and mixing tools. The Remixing Studio, a 16-part, multi-timbral, 256-voice sampler, is your main workspace. In it, computer keys take the place of traditional MIDI keys for triggering TRK or WAV files, and a W.A.R.P. feature applies realtime effects to the entire mix. The Recording Studio transfers files to any sample-editing program, including the limited version of Steinberg's *Wavelab* that's included in the package. In the FX Studio, you can apply up to five different effects algorithms to a sound, non-destructively storing the result in RAM—which not only saves wear on your hard drive, but also allows for quicker triggering of the sounds and faster processing. The Editing Studio, which acts very much like a sequencer and enables graphical editing of a performance, got our vote for most interesting feature. From here, you can export your creations in a variety of formats, including WAV, MP3, RealAudio, SoundFont Bank, or MixMan's own Track File.



Remixing, FX, Recording, and Editing are all performed by Studio Pro's "studios."

Alas, there are a few flies in the *Studio Pro* ointment, the biggest being Mixman's Gestapo-like licensing restrictions stating that any .trk files created with the software cannot be distributed or resold—including original creations. We were also displeased by the lack of support for MIDI input/output, without which you'll be forced to press tiny keys on a computer keyboard in order to input your jams—and who wants to plug away at that kind of task when the creative juices are flowing? We'd also be happier if future versions of *Studio Pro* included industry-standard DirectX plug-ins.

Quibbles aside, we think *StudioPro* is a capable addition to any professional or hobbyist's repertoire of audio tools.

PLUSES
- Beat-matched tracks are always in synch
- Easy to use
- Editing Studio is awesome
- 23 effects groups

MINUSES
- Original .trk files can't be distributed or resold
- No MIDI input/output
- No DirectX plug-in support
- Can't Alt-Tab to Windows without quitting the program

MAXIMUM PC VERDICT

Price $90
Company MixMan Technologies
Phone 888.465.9626
URL www.mixman.com

8

GrooveMaker

Cakewalk is best known for its excellent sequencer of the same name. We were looking for the same quality from *GrooveMaker*, which bills itself as a "tool" that techno DJs can use to lay down phat tracks. Sadly, what we saw instead was an unsuccessful attempt to copycat other, better products, such as Mixman's *Studio Pro*.

GrooveMaker is housed on four hybrid PC/MAC CD-ROMs that contain the application and sixteen sample songs in 22khz and 44khz formats. Mixes can be saved in either format and broken into eight separate WAV files, corresponding to each track of the sequence. Once the program is running, you can get the party started by loading one of the provided sample tracks—but be careful, because once you begin to preview a tune, you can't turn it off until the song is over. If you try to stop the CD from playing or, as we did, try to eject the CD-ROM, you'll be subjected to a loud, piercing squeal as a punishment for your premature ejection. The easiest way around this dilemma, or any difficulty encountered with the program, is the ESC key.

Trying to figure out GrooveMaker's circle of chaos is well beyond the capacity of most DJ's in a high-stress environment like a rave.

In spite of the bad-mannered howling, *GrooveMaker* did play nice with other programs we had running; unlike *Studio Pro*, *GrooveMaker* had no problem with using the old ALT+TAB combo to navigate through and switch around to our other open programs. That's a good thing, since switching to other programs is something you'll be doing often while using *GrooveMaker*. It demonstrated painfully slow response times to even the simplest of mouse clicks—and we were running it on our 450MHz K6-3 system with 128MB, PC100 RAM. Even *GrooveMaker*'s molasses-like speed wouldn't be so irritating if the GUI was laid out more intuitively, and the program wasn't suffering from such a lame attempt to be "hip."

In the end, what really matters is the music. With *GrooveMaker*, we use the term "music" loosely. Even with our dope DJ skills, the tunes *GrooveMaker* turned out were tedious and boring; we find it hard to believe that any raver worth his or her glow-sticks would be hopping and dancing all night to any of the—and we're quoting here—"80 million possible groove combinations."

PLUSES
- Four CD-ROMS
- Imports standard WAV files
- Large sample library included

MINUSES
- Slow and confusing GUI
- Monotonous audio tracks
- Poorly designed

MAXIMUM PC VERDICT

Price $35
Company Cakewalk
Phone 888.225.3925
URL www.cakewalk.com

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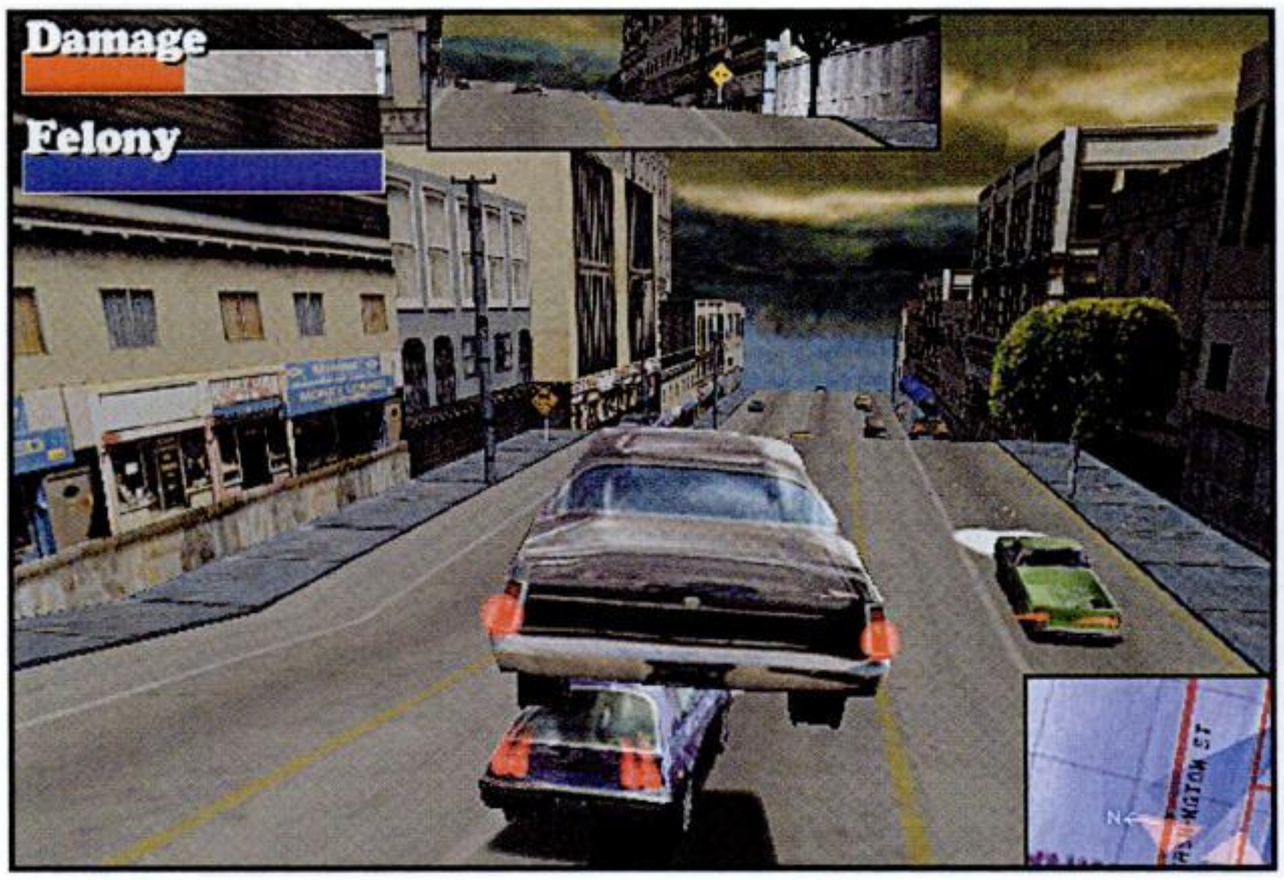
Driver

DUKES OF HAPHAZARD

One of the highest rated Playstation games of all time has come to the PC, and it looks as though quite a bit was lost in the translation.

In *Driver*, you play as Tanner, an undercover cop trying to infiltrate a crime syndicate. As the group's getaway driver, you help them to stay one step ahead of The Man throughout the game's various missions, while gathering and reporting on their dastardly doings. Although it's a mildly interesting spin on a driving game plot, *Driver*'s story ultimately seems shoddily constructed—which perfectly matches the feeling we got from the rest of the game.



THE SPECS

3D HARDWARE SUPPORT
- Direct 3D
- Glide
- DirectSound

CONTROLLER SUPPORT
- Force feedback
- Joystick
- Wheel

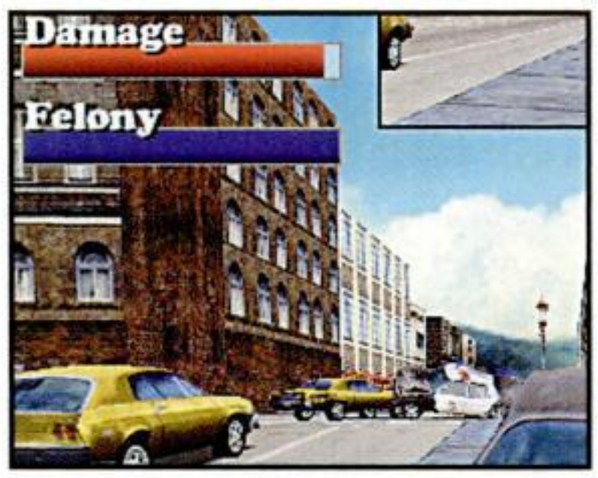
MULTIPLAYER
- None

PLUSES
- Director mode
- Fun for about five minutes

MINUSES
- Bad pop-up
- Horrible AI
- Fun for about five minutes

Graphically, *Driver* is similar to *Midtown Madness*, though not as pretty. The game does a good job of depicting real-world locations, if you believe there are actually places where the road never, ever curves. Coupled with the fact that every city's streets look similar, the scenery gets old fast.

Driver is also crippled by some of the worst pop-up we've ever witnessed in a PC game. It's so distracting, we crashed our ride several times. The only object that demonstrates any level of environment mapping is your vehicle—but texture changes are only affected by your vehicle's speed, so forget realistic reflections from changing light sources or shadows. The damage model is also unrealistic, so the slightest fender-bender can cause massive amounts of damage to your ride.



Driver's felony and damage meters let you know how illegal your driving is, and how much longer your car will hold up.

Don't get us wrong—too much realism isn't any fun. But why depict a car in a "real" city environment when everything else seems to be taking place in fantasyland? For example, the police AI is so unrealistic, it's laughable. At times, the fuzz literally appears from thin air, and these excessively brave officers will literally risk life and limb—their own, and those of every innocent bystander within reach—in order to bring you to justice. This includes ramming your car head-on in the middle of a busy downtown intersection. They're also incredibly efficient: If you cause an accident and return to the scene of the crime just minutes later, you'll find that all traces of the crash have been removed.

Driver puts you behind the wheel of a gang's getaway vehicle. Don't go around traffic—go over it.

Force feedback support is included, but it's more of a hindrance than an enhancement. The implementation is weak and makes steering difficult, and impact forces are non-existent, so crashing into a wall at 70 mph yields a big, fat nothing. Ditto for driving on slippery grass, rolling over bumps in the road, or hitting the ground with impact after pulling off a mad jump.

The characters you interact with all come across as racial stereotypes. Asian characters sound like Arnold from "Happy Days," and African Americans are apparently modeled on the Marseilles Wallace character in *Pulp Fiction*.

Driver has no multiplayer capability, but we can't imagine its inclusion would be an improvement. One semi-cool feature is a Director mode, in which you can edit instant replays of your driving that are recorded each time you play a level. In Director mode, you can change camera angles, zoom in and out, and rotate the camera around your vehicle during playback. It's a neat feature that's fun for a bit, but even this distraction eventually gets old. Playing the game was bad enough, so why would we want to watch a replay of it?

In case you couldn't tell, we think this game sucks. *Driver* has driven us to pin all our hopes for a fun driving sim on *Interstate '82*. Watch this space for a review.

—Kenn Durrence

MAXIMUM PC VERDICT

Price $40
Company GT Interactive
Phone 800.469.5961
URL www.gtinteractive.com

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Football Roundup 2000

DOWN N' DIRTY GRIDIRON ACTION

Last year we tackled four fab football titles, but this year's draft offered up just two: a grizzled veteran and a surprising first-round pick from a *really* big school. Although neither stands up to the mind-blowing Dreamcast *NFL 2K*, this pair of pigskin pros is the best thing going for our beloved PC.

—Phil Lacefield Jr.

Terrell Davis plants yet another Broncos touchdown against the Cardinals in NFL Fever 2000.

NFL Fever 2000

MAXIMUM PC KICK-ASS! product

After tenuously dipping a toe into baseball waters, Microsoft cannonballs into the football deep end with the impressive *NFL Fever 2000*, leaving everyone behind in the ensuing tidal wave. Motion-capped player animations are smooth and vibrant; stadiums look gorgeous; and accurate weather, team-specific cheers, and crowd noise give major flavor to the action. The interface is a dream come true, with downloadable roster updates, customizable playbooks for every team, free agent creation, and the ability to trade players to you heart's content. The game allows you to complete the entire 1999 season, all the way from preseason to Super Bowl, at your choice of difficulty levels—all for a measly twenty bucks! Even the new Cleveland and Tennessee teams and stadiums are properly depicted, along with every end-zone celebration dance known to man.

PLUSES
- Beautiful animations
- Easy control

MINUSES
- No net/LAN multiplayer support
- Occasional graphical glitches
- Empty sidelines

What's *not* to love about this game? Three things, it turns out. First, there's nobody on the sidelines—ever. No benches, no cheerleaders, no nothing, so the gorgeous stadiums look deserted in all their 1024x768 high-res glory. Second, there's no detailed stats mode, so number-crunching fans will be disappointed. Third, there's no support for Internet, modem, or LAN play, so your opponents have to be in the same room with you.

But those are the only minor bitches we could come up with, and that doesn't happen very often. *NFL Fever 2000*, the newest kid on the PC football block, kicks thirty-one flavors of ass and then some.

THE SPECS

3D CARD SUPPORT
Direct 3D

3D SOUND SUPPORT
None

MULTIPLAYER
None

TOTAL PLAYERS
2

MAXIMUM PC VERDICT

Price $20
Company Microsoft
Phone 888.218.5617
URL www.microsoft.com/games

9

Madden 2000

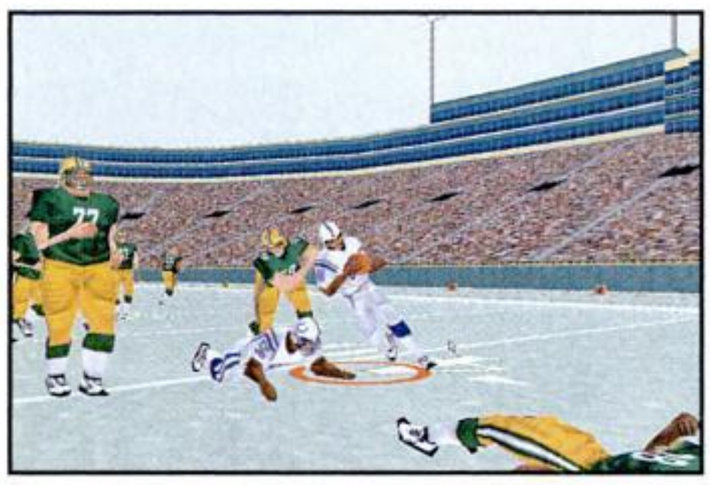
After eight championship seasons and two years of solid 3D graphics, EA Sports forks over another pile of football goodness with *Madden 2000*, the game that, at one point, virtually defined the genre.

For 2000, the franchise offers a new "drag-and-drop" interface and beefed-up multiplayer options, so you can tackle your friends over the net. *M2K*'s "Multiplayer Franchise mode" lets you compete online for over 30 consecutive seasons, and once you're no longer a rookie, an online scouting service can match you up against opponents of similar skill for multiplayer action.

PLUSES
- Maniacal stat management
- Online options abound

MINUSES
- Interface from Hell
- No gameplay innovation

Unfortunately, the new and "improved" interface royally sucks.



Madden 2000's weather effects let you feel the chill at Green Bay—look at the footprints in the snow!

The flimsy CD insert forks over precious little info on the intricacies of the game, leaving you to fumble through various menus and submenus with no idea of how to move things or select options. It doesn't matter whether you're using keystrokes, mouse clicks, or a gamepad—nothing works well.

Once you get past the annoying interface and into the action, *Madden* begins to shine. Colorful commentary from Pat Summerall and Madden himself are a welcome return, and a new *Madden* challenge tests your gridiron trivia skills and rewards you by unlocking "All Century" teams and fantasy stadiums.

Gameplay remains basically unchanged, but that may be OK with you if *Madden* has always been your first choice for gridiron action on the PC. Although it's not the only game in town anymore, thanks to the boys from Redmond, *Madden 2000*'s Internet options and bone-crushing gameplay will appeal to armchair quarterbacks everywhere.

THE SPECS

3D CARD SUPPORT
Glide | Direct 3D

3D SOUND SUPPORT
EAX Sound | DirectSound

MULTIPLAYER
TCP/IP | Serial | IPX | Modem

TOTAL PLAYERS
8

MAXIMUM PC VERDICT

Price $40
Company EA Sports
Phone 800.245.4525
URL www.easports.com

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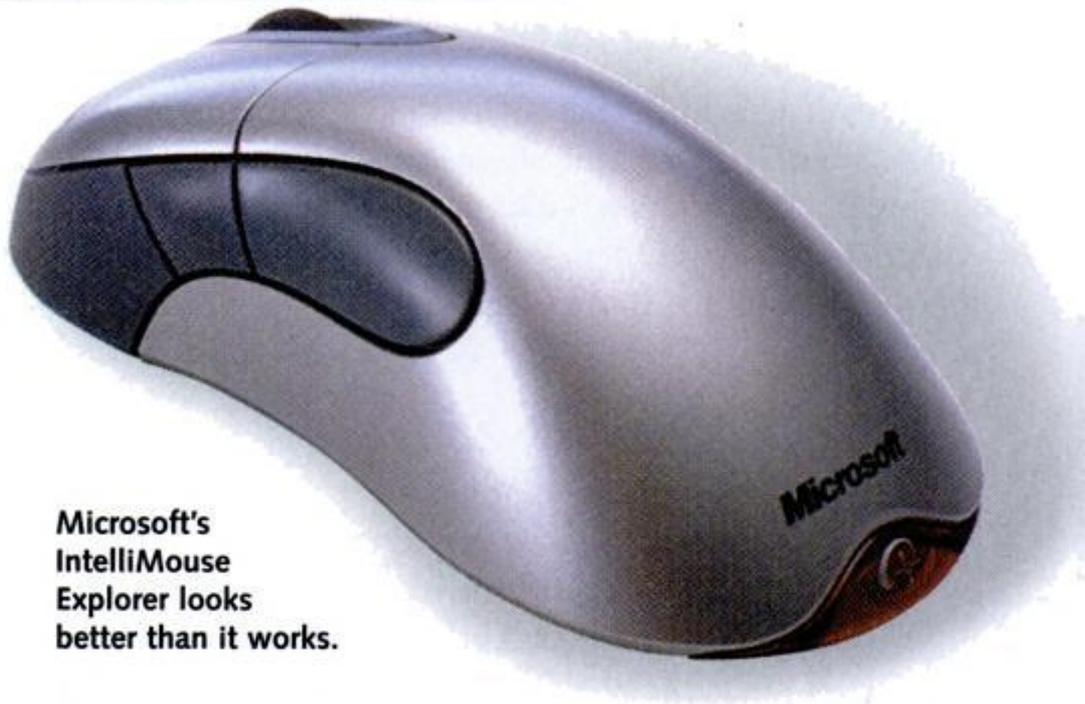
IntelliMouse Explorer

THIS MOUSE HAS NO BALLS!



Microsoft's IntelliMouse Explorer looks better than it works.

Using Microsoft's optical mouse is like putting your hands on a Ouiji board: You move the mouse, and the cursor responds as though The Force is controlling it. That force is Microsoft's IntelliEye technology, which employs a digital camera instead of a mouse ball in order to control pointer movement. The camera snaps 1,500 images per second of the mousing surface and sends the images to a Digital Signal Processor (DSP) that converts the changes in movement to changes in the movement of the screen cursor—all with no mousepad required. In fact, a mousepad is discouraged; we found that the varying patterns on some pads tend to throw off the system.

PLUSES
- Optical tracking works well
- No more mouse-ball cleaning

MINUSES
- Excessive girth is awkward to hold
- No mousepad means no wrist-rest
- Software bundle is status quo

The IntelliMouse features a scroll wheel and four buttons—two on top and two on the thumb-side—on a silver, streamlined case. Clicking action is unsatisfactory because of the buttons' overwhelmingly soft feel, and getting to the second thumb button required us to move our whole hand, which was frustrating.

Unfortunately, the optical camera is the only thing to really go ga-ga over. The *IntelliMouse* software brings nothing new to the table and, though they can be programmed to execute a ton of useful clicking functions, we found the four buttons to be overkill.

For gaming purposes, the mouse is capable, but hardly our first pick. Its large size is unwieldy at times, and the left-click key's seemingly long return time impeded our destructive capabilities in online deathmatches. The optical tracker performed its duties well, and only lost track of the mouse pointer during insanely fast quick-flick maneuvers.

Microsoft's IntelliMouse is certainly innovative, and performs admirably for most desktop tasks. But its fat price, light features, and optical sensor just weren't our cup of tea—we like mice with balls.

—Josh Norem

MAXIMUM PC VERDICT

Price $75
Company Microsoft
Phone 800.426.9400
URL www.microsoft.com/hardware/mouse/intellimouse.html

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w/ Subwoofer and Remote Volume Control
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Microsoft Intellimouse Explorer (Optical) USB
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COMPUTER GAMING WORLD
EDITORS' CHOICE

1999 CGW Ultimate Game Machine
"Bang for the Buck" Competition
"Hypersonic PC Silver Bullet SE System"

COMPUTER GAMING WORLD
★★★★½

Defining
THE GAMING PC

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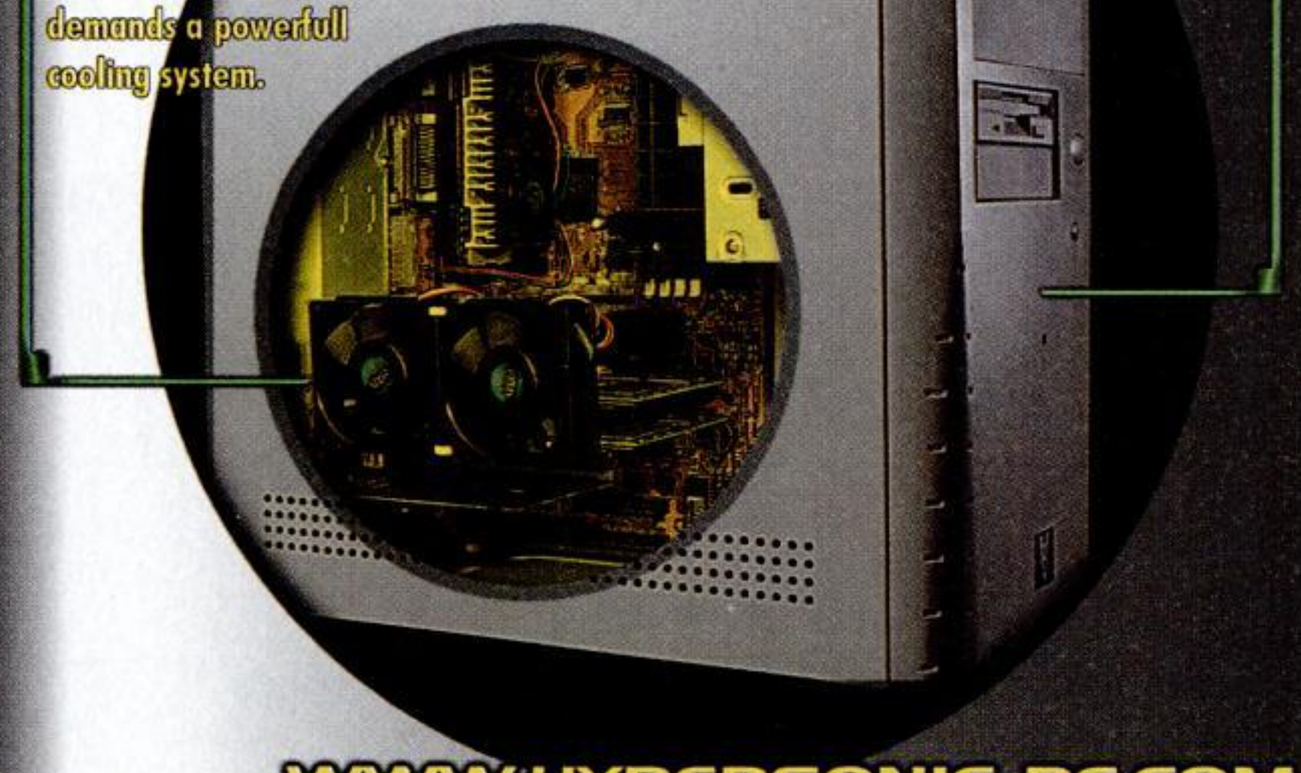

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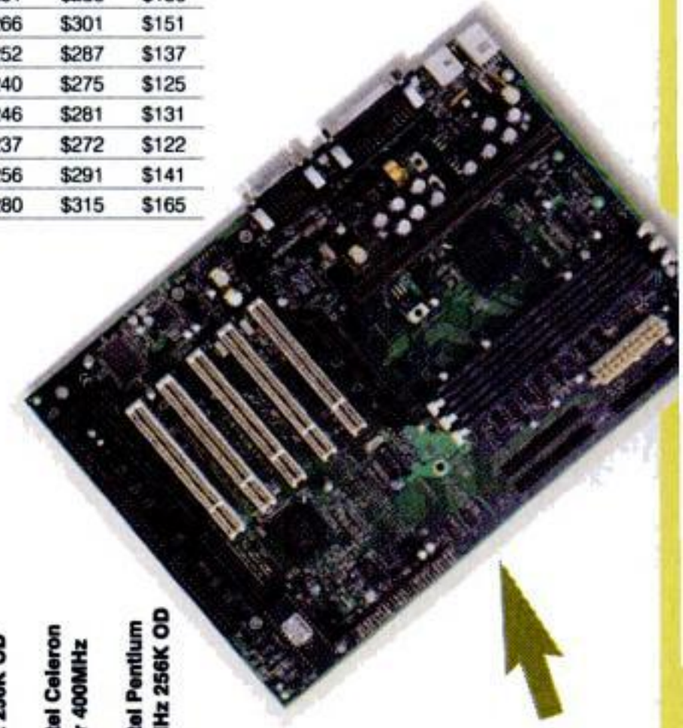
Super7™	Part Number	Chip Set	L2 Cache (KB)	Maximum Memory (MB)	168-pin DIMM Sockets	72-pin SIMM Sockets	Flash BIOS	Integrated Audio	Integrated Controller	PCI Slots	ISA Slots	AGP Slot	Format	Manufacturer's Warranty	Motherboard Only	w/AMD-K6®-2/400 with 3DNow!™	w/AMD-K6-2/450	w/AMD-K6-2/475	w/AMD-K6-2/500	w/AMD-K6-III/400	w/AMD-K6-III/450	w/AMD-K6-III/500	w/Intel® Pentium® MMX™ 233MHz
Asus P5A	*MB5710*	ALi® Aladdin V	512	384	3		Award			5	2	1	ATX	1 Yr.	$97	$147	$161	$185	$209	$207	$257	$292	$142
Asus P5A-B	*MB5711*	ALi Aladdin V	512	384	3		Award			3	2	1	Baby AT	1 Yr.	$96	$146	$160	$184	$208	$206	$256	$291	$141
EPoX EP-MVP3C2	*MB5406*	VIA Apollo MVP3	512	384	3		Award		UltraDMA/66	4	2	1	Baby AT	2 Yrs.	$82	$132	$146	$170	$194	$192	$242	$277	$127
EPoX EP-MVP3G5	*MB5405*	VIA Apollo MVP3	2048	384	3		Award		UltraDMA/66	5	2	1	ATX	2 Yrs.	$108	$158	$172	$196	$220	$218	$268	$303	$153
EPoX EP-MVP4-A	*MB5403*	VIA Apollo MVP4	512	768	3		Award	AC-97	UltraDMA/66	4	2		ATX	2 Yrs.	$91	$141	$155	$179	$203	$201	$251	$286	$136
FIC PA-2013 (2MB Cache)	*MB5214*	VIA Apollo MVP3	2048	384	3		Award			4	2	1	ATX	1 Yr.	$106	$156	$170	$194	$218	$216	$266	$301	$151
FIC PAG-2130	*MB5215*	VIA Apollo MVP4	1024	768	3		Award	ESS	UltraDMA/66	4	1		MicroATX	1 Yr.	$92	$142	$156	$180	$204	$202	$252	$287	$137
FIC VA-503+	*MB5211*	VIA Apollo MVP3	1024	512	2	4	Award			3	3	1	Baby AT	1 Yr.	$80	$130	$144	$168	$192	$190	$240	$275	$125
FIC VA-503A	*MB5212*	VIA Apollo MVP3	1024	768	3		Award	ESS	UltraDMA/66	4	1	1	Baby AT	1 Yr.	$86	$136	$150	$174	$198	$196	$246	$281	$131
Shuttle HOT-591P	*MB5611*	VIA Apollo MVP3	512	256	2	2	Award			3	3	1	Baby AT	1 Yr.	$77	$127	$141	$165	$189	$187	$237	$272	$122
Tyan S1590S Trinity 100AT	*MB5006*	VIA Apollo MVP3	1024	384	3	2	Award			4	4	1	Mini AT	3 Yrs.	$96	$146	$160	$184	$208	$206	$256	$291	$141
Tyan S1598 Trinity ATX	*MB5008*	VIA Apollo MVP3	2048	384	3		Award		UltraDMA/66	5	2	1	ATX	3 Yrs.	$120	$170	$184	$208	$232	$230	$280	$315	$165

Slot A	Part Number	Chip Set	Maximum Memory (MB)	168-pin DIMM Sockets	Flash BIOS	Bus Frequency	Integrated Controller	PCI Slots	ISA Slots	AGP Slot	Format	Manufacturer's Warranty	Motherboard Only	w/AMD Athlon™ 550MHz	w/AMD Athlon 600MHz	w/AMD Athlon 650MHz	w/AMD Athlon 700MHz	w/AMD Athlon 750MHz
AMD K7M	*MB7701*	AMD-751 / VIA 686A	768	3	Award	100/120/133	UltraDMA/66	5	1	1	ATX	1 Yr.	$199	$514	$679	$799	$979	$1179
FIC SD11	*MB7401*	AMD-751 / VIA 686A	768	3	Award	100/120/133	UltraDMA/66	5	1	1	ATX	1 Yr.	$159	$474	$639	$759	$939	$1139
GVC QS750	*MB7601*	AMD-750	768	3	Award	100	UltraDMA/66	4	3	1	ATX	1 Yr.	$143	$458	$623	$743	$923	$1123
Microstar MS-6167	*MB7201*	AMD-750	768	3	Award	100	UltraDMA/66	5	2	1	ATX	1 Yr.	$159	$474	$639	$759	$939	$1139



Socket 370	Part Number	Chip Set	Maximum Memory (MB)	168-pin DIMM Sockets	Flash BIOS	Integrated Audio	Integrated Video	PCI Slots	ISA Slots	AGP Slot	AMR Slot	Format	Manufacturer's Warranty	Motherboard Only	w/Intel® Celeron™ processor 400MHz	w/Intel Celeron processor 433MHz	w/Intel Celeron processor 466MHz	w/Intel Celeron processor 500MHz	w/Intel Pentium® III 500E MHz 256K OD	w/Intel Pentium III 550E MHz 256K OD	w/Dual Intel Celeron processor 400MHz	w/Dual Intel Pentium III 550E MHz 256K OD
ABIT BM6	*MB6504*	Intel 440BX	768	3	Award			5	2	1		ATX	1 Yr.	$112	$180	$193	$223	$271	$397	$547	N/A	N/A
ABIT BP6 (Dual)	*MB6506*	Intel 440BX	768	3	Award			5	2	1		ATX	1 Yr.	$149	$217	$230	$260	$308	$434	$584	$285	$1019
EPoX EP-3VBA	*MB6851*	VIA Apollo Pro+	768	3	Award	AC-97		4	1	1	1	ATX	2 Yrs.	$85	$153	$166	$196	$244	$370	$520	N/A	N/A
SuperMicro 370SBA	*MB6131*	Intel 440BX	768	3	AMI			4	3	1		ATX	1 Yr.	$111	$179	$192	$222	$270	$396	$546	N/A	N/A
SuperMicro 370SEA	*MB6140*	Intel 810e	512	2	AMI	Intel 810e	Intel 810e	6	1		1	ATX	1 Yr.	$143	$211	$224	$254	$302	$428	$578	N/A	N/A
Tyan S1854 Trinity 400	*MB6018*	VIA Apollo Pro 133A	768	3	Award			6	1	1		ATX	3 Yrs.	$115	$183	$196	$226	$274	$400	$550	N/A	N/A

Slot 1	Part Number	Chip Set	Maximum Memory (MB)	168-pin DIMM Sockets	168-pin RIMM Sockets	Flash BIOS	Integrated Audio	Integrated Controller	PCI Slots	ISA Slots	AGP Slot	Format	Manufacturer's Warranty	Motherboard Only	w/Intel Pentium III processor 450MHz 512K 100MHz FSB	w/Intel Pentium III 500 512K 100MHz FSB	w/Intel Pentium III 533EB 256K OD 133MHz FSB	w/Intel Pentium III 550 512K 100MHz FSB	w/Intel Pentium III 600E/EB 256K OD 100/133MHz FSB	w/Intel Pentium III 650 256K OD 100MHz FSB	w/Intel Pentium III 667 256K OD 133MHz FSB	w/Intel Pentium III 700 256K OD 100MHz FSB	w/Intel Pentium III 733 256K OD 133MHz FSB	w/Dual Intel Pentium III 700 256K OD 100MHz FSB
ABIT BE6-II	*MB6508*	Intel 440BX	768	3		Award		UltraDMA/66	5	1	1	ATX	1 Yr.	$152	$352	$417	N/A	$562	$677	$817	N/A	$1017	N/A	N/A
ABIT BF6	*MB6507*	Intel 440BX	768	3		Award			6	1	1	ATX	1 Yr.	$122	$322	$387	N/A	$532	$647	$787	N/A	$987	N/A	N/A
ABIT BX6 (2.0)	*MB6502*	Intel 440BX	1024	4		Award			3	2	1	ATX	1 Yr.	$141	$341	$406	N/A	$551	$666	$806	N/A	$1006	N/A	N/A
Asus P2B98-S	*MB6706*	Intel 440BX	1024	4		Award			5	2	1	ATX	2 Yrs.	$329	$529	$594	N/A	$739	$854	$994	N/A	$1194	N/A	N/A
Asus P2B98-DS	*MB6707*	Intel 440BX	1024	4		Award			4	2	1	ATX	1 Yr.	$469	$669	$734	N/A	$879	$994	$1134	N/A	$1334	N/A	$2199
Asus P2B-B	*MB6714*	Intel 440BX	768	3		Award			4	2	1	Baby AT	1 Yr.	$137	$337	$402	N/A	$547	$662	$802	N/A	$1002	N/A	N/A
Asus P3B-F	*MB6720*	Intel 440BX	1024	4		Award			6	1	1	ATX	1 Yr.	$144	$344	$409	N/A	$554	$669	$809	N/A	$1009	N/A	N/A
Asus P3B-1394	*MB6721*	Intel 440BX	512	2		Award	AC-97	UltraDMA/66	3		1	MicroATX	1 Yr.	$199	$399	$464	N/A	$609	$724	$864	N/A	$1064	N/A	N/A
EPoX EP-6VBA	*MB6852*	VIA Apollo Pro+	768	3		Award	AC-97	UltraDMA/66	4	2	1	ATX	3 Yrs.	$89	$289	$354	N/A	$499	$614	$754	N/A	$954	N/A	N/A
FIC KA11	*MB6411*	VIA Apollo Pro 133A	1024	4		Award		UltraDMA/66	5	2	1	ATX	1 Yr.	$109	$309	$374	N/A	$519	$634	$774	N/A	$974	N/A	N/A
Intel L440GX+	*MB6917*	Intel 440GX	2048	4		Intel/Phoenix		Adaptec 2-Ch U2W	6	1		ATX	3 Yrs.	$519	$719	$784	N/A	$929	$1044	$1184	N/A	$1384	N/A	$2249
SuperMicro PIIISCA	*MB6141*	Intel 820	1024	2	2	AMI	AC-97	UltraDMA/66	5		1	ATX	1 Yr.	$144	$344	$409	$479	$554	$669	$809	$834	$1009	$1034	N/A
SuperMicro PIIISED	*MB6142*	Intel 810e	512	2		AMI	AC-97	UltraDMA/66	6			ATX	1 Yr.	$129	$329	$394	$464	$539	$654	$794	$819	$994	$1019	N/A
SuperMicro PIIIDME	*MB6151*	Intel 840	4096	6		AMI	AC-97	Intel PRO/100+	6		1	ATX	1 Yr.	$329	Call	Call	$664	Call	$854	Call	$1019	Call	$1219	Call
SuperMicro P6DGH	*MB6129*	Intel 440GX	2048	4		AMI		Adaptec 2-Ch U2W	9	2	1	Full AT	1 Yr.	$799	$999	$1064	N/A	$1209	$1324	$1464	N/A	$1664	N/A	$2529
SuperMicro P6DGU	*MB6122*	Intel 440GX	2048	4		AMI		Adaptec U2W	5	2	1	ATX	1 Yr.	$459	$659	$724	N/A	$869	$984	$1124	N/A	$1324	N/A	$2189
SuperMicro P6SBA	*MB6120*	Intel 440BX	768	3		AMI			4	3	1	ATX	1 Yr.	$129	$329	$394	N/A	$539	$654	$794	N/A	$994	N/A	N/A
SuperMicro P6SBU	*MB6128*	Intel 440BX	1024	4		AMI		Adaptec U2W	4	3	1	ATX	1 Yr.	$329	$529	$594	N/A	$739	$854	$994	N/A	$1194	N/A	N/A
Tyan S1857 Trinity 371	*MB6017*	Intel 440BX	768	3		AMI			6	1	1	ATX	3 Yrs.	$109	$309	$374	N/A	$519	$634	$774	N/A	$974	N/A	N/A
Tyan S1854 Trinity 400	*MB6018*	VIA Apollo Pro 133A	768	3		Award		UltraDMA/66	6	1	1	ATX	3 Yrs.	$119	$319	$384	N/A	$529	$644	$784	N/A	$984	N/A	N/A

Slot 2	Part Number	Chip Set	Maximum Memory (MB)	168-pin DIMM Sockets	Flash BIOS	Integrated Audio	Integrated Video	Integrated Controller	Integrated Networking	PCI Slots	ISA Slots	AGP Slot	Format	Manufacturer's Warranty	Motherboard Only	w/Intel Pentium III Xeon 550MHz 512K	w/Intel Pentium III Xeon processor 550MHz 1024K cache	w/Intel Pentium III Xeon 550MHz 2048K	w/Dual Intel Pentium III Xeon 550MHz 512K	w/Dual Intel Pentium III Xeon 550MHz 1024K	w/Dual Intel Pentium III Xeon 550MHz 2048K	w/Quad Intel Pentium III Xeon 550MHz 512K	w/Quad Intel Pentium III Xeon 550MHz 1024K	w/Quad Intel Pentium III Xeon 550MHz 2048K
AMI MegaPlex II	*MB6215*	Intel 450NX	4096	16	AMI		2MB ATI			7	1		9U Rack	1 Yr.	$3995	$5095	$6325	$8335	$6195	$8655	$12675	$8395	$13315	$21355
AMI MegaPlex II	*MB6216*	Intel 450NX	2048	8	AMI		2MB ATI			7	1		4U Rack	1 Yr.	$3649	$4749	$5979	$7989	$5849	$8309	$12329	$8049	$12969	$21009
Asus XG-DLS	*MB6713*	Intel 440GX	2048	4	AMI			Adaptec 2-Ch U2W	Intel PRO/100+	5	1	1	ATX	1 Yr.	$779	$1879	$3109	$5119	$2979	$5439	$9459	N/A	N/A	N/A
SuperMicro S2DM3	*MB6150*	Intel 840	4096	6	AMI	AC-97		Adaptec Ultra3/160m	Intel PRO/100+	6		1	ATX	1 Yr.	Call	Call	Call	Call	Call	Call	Call	N/A	N/A	N/A
SuperMicro S2DG2	*MB6136*	Intel 440GX	2048	4	AMI			Adaptec 2-Ch U2W		5	2	1	ATX	1 Yr.	$549	$1649	$2879	$4889	$2749	$5209	$9229	N/A	N/A	N/A
SuperMicro S2DGE	*MB6135*	Intel 440GX	2048	4	AMI					5	2	1	ATX	1 Yr.	$329	$1429	$2659	$4669	$2529	$4989	$9009	N/A	N/A	N/A
Tyan **S1952D Thunder X**	*MB6013*	Intel 440GX	2048	4	AMI			Adaptec 2-Ch U2W		6	1	1	Mod. ATX	1 Yr.	$579	$1679	$2909	$4919	$2779	$5239	$9259	N/A	N/A	N/A

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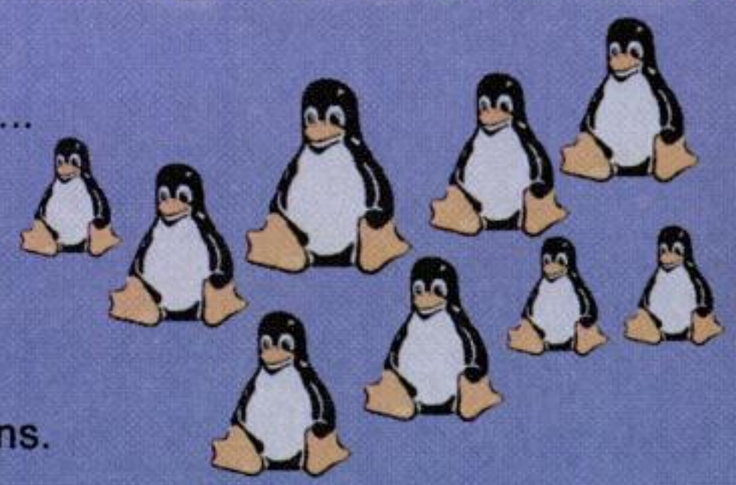

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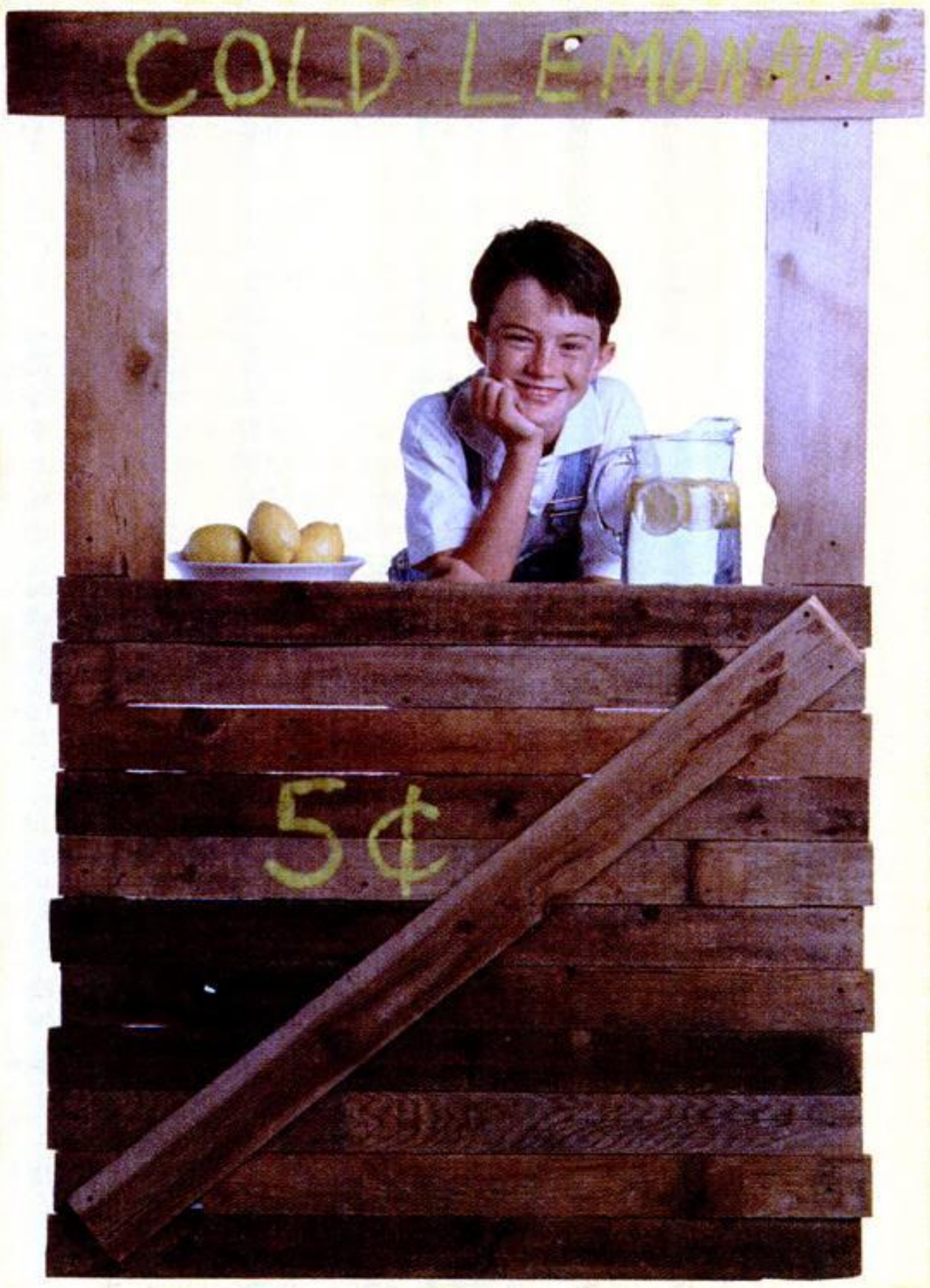

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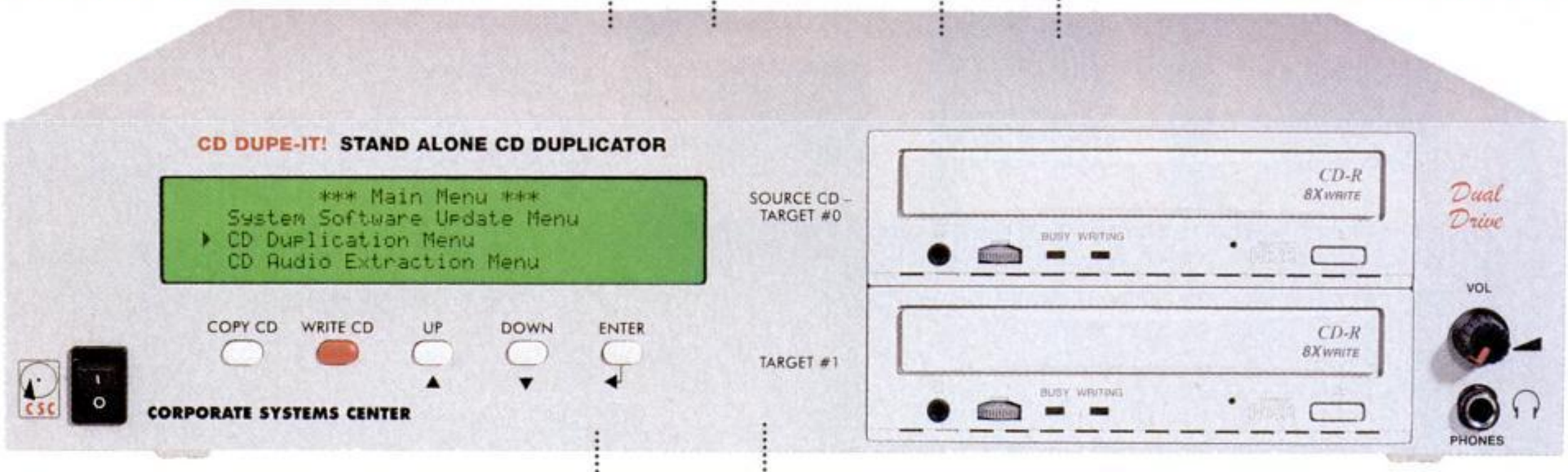

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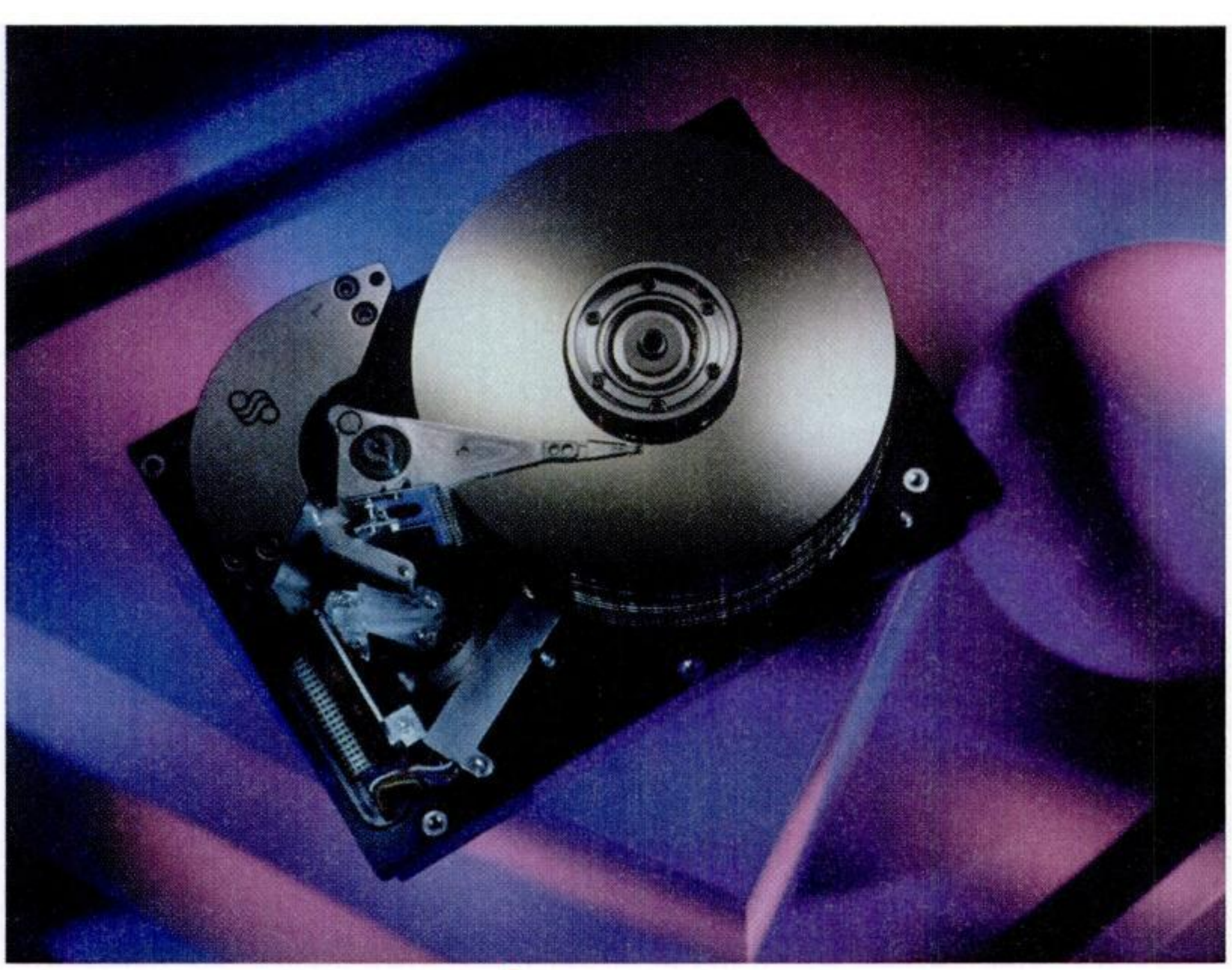

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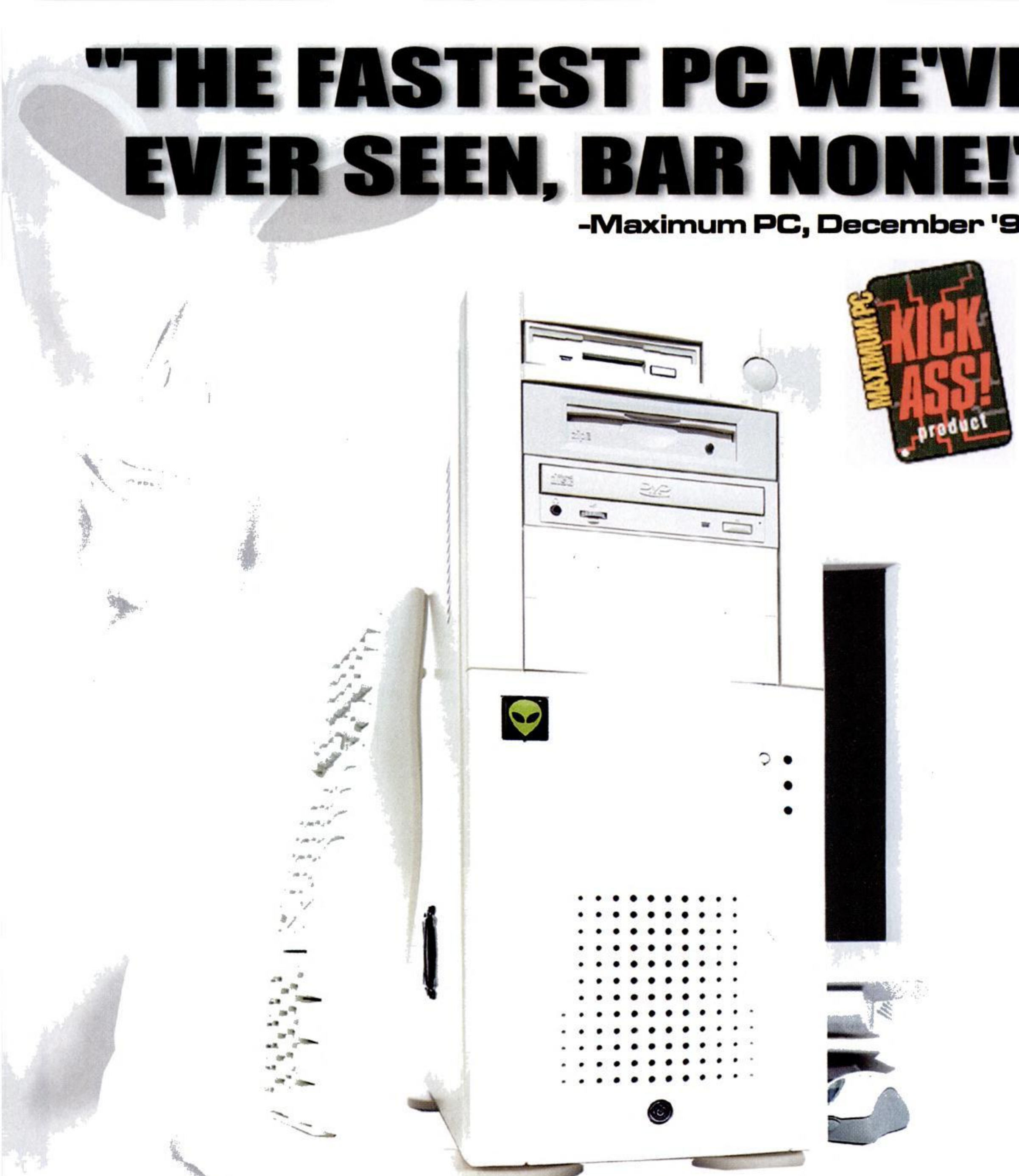

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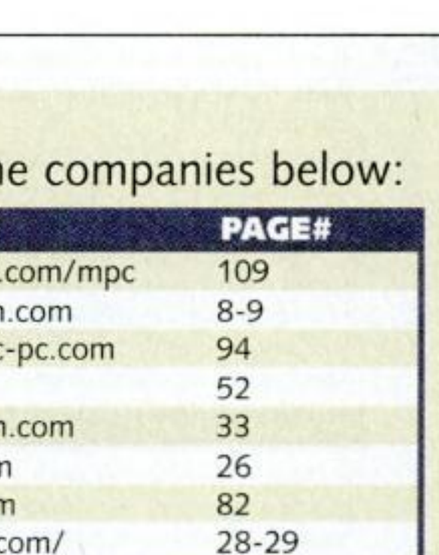

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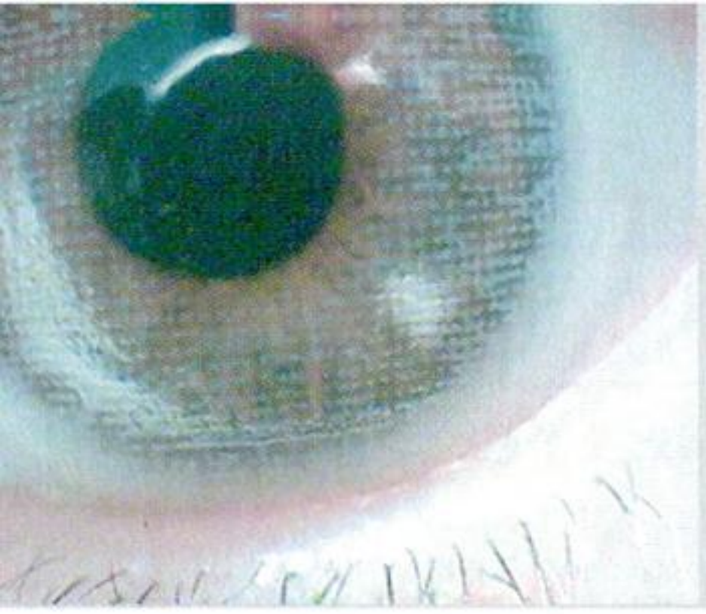

TERMINATOR

Tech Terms Revealed ▶

Technical terms found throughout MAXIMUM **PC are** underlined and in blue**.** Hyperlink back to here for revelation and further **explanation.** Terms appearing in **blue** within **the Terminator are updated** definitions **of** previously explained concepts.

A

Areal density Amount of data that can be packed onto a storage medium, generally measured in gigabits per square inch.

ATA/66 An enhanced version of the IDE I/O interface that supports 66MB/sec.

B

Beat matching A process whereby the computer calculates the proper tempo relative to a given audio track without changing the pitch.

Blue Something or someone that is sad, cold, the color of the sky, or suddenly interrupted in the middle of a sexual act.

Buffers See cache

C

Cache A dedicated or reserved bank of memory used to improve a computer's performance. It provides a temporary storage area for instructions and data that acts as a fast swap to and from your CPU.

D

Datapaths The channels through which data travels in a CPU die.

Digital Signal Processor (DSP) A special type of microprocessor chip optimized for performing repetitive operations on large sets of data. DSPs are often used for communications, networking, and multimedia tasks.

Dipole-radiating Technology that creates multiple distinct image sources from a single speaker to create a more expansive soundstage with more precision tone placement.

Discrete L2 cache Cache memory that is detached and not on the processor die itself.

Dolby Digital 5.1 Audio format that uses encoding developed by Dolby Labs to deliver six channels (front left and right, rear left and right, center, and subwoofer) of discrete signal to the speaker system.

E

EIDE Enhanced Integrated Drive Electronics. A motherboard interface for connecting hard drives, CD/DVD-ROM drives, and removable storage devices.

Embedded memory Systems on a chip. Multiple programs are integrated into a single chip, reducing the power required to run them.

Environment mapping A texture effect that applies a reflection of the surrounding game environment on the texture itself. This is useful for giving textures a highly reflective appearance, such as simulating chrome.

F

Fill rates The number of pixels that a videocard pumps on screen during a fixed span of time; measured in millions of pixels per second.

FireWire a.k.a. IEEE 1394, this spec allows for the transport of data up to 200Mbps, the ability to add and remove devices without powering them down first, and the ability daisychain up to 63 devices with cable lengths up to 14 feet.

Floating point A fractional number, such as 9.95 or 98.6.

G

GMR (giant magnetoresistive) In 1988, scientists in France and Germany discovered that certain thin-film sandwiches had large magnetoresistance, which they termed "giant magnetoresistance." IBM scientists discovered ways to use standard manufacturing techniques to make GMR structures that had greater MR at room temperature and lower fields than the sensors used in MR heads. In 1997, IBM introduced the GMR head, in which a GMR sandwich replaced the MR element and continued the spectacular increase in disk drive densities and capacities.

GUI Graphical user interface. The windows, buttons, menus, scrollbars, and other graphical elements that allow a user to control a program.

H

Hardware transform and lighting Offloading the geometry portion of the 3D pipeline from the CPU to the processor aboard a videocard. The geometry stage of 3D rendering involves coordinating the placement of each object according to the ever-changing perspective of the player.

Hex HEXadecimal. The base-16 numbering system, used as shorthand for representing binary numbers, employs hex digits to represent decimal and binary equivalents.

Hue A color's dominant wavelength. In a color system, colors are measured by hue, saturation, and luminance: Hue is the predominant color.

I

IA-64 Intel Architecture 64, a 64-bit CPU architecture owned by Intel, and designed as the successor to the x86 architecture.

Instructions The menu of specific mathematic actions that a CPU uses to crunch data.

IR interface Infrared interface. Used like a remote control on a TV, it can send data from one device to the next.

IRQs Interrupt Request. Unless coded to cooperate with each other, no two parts of a computer can access CPU cycles at the same time. Installed devices must therefore send Interrupt Requests to the operating system, asking for the processor's undivided attention.

ISA Industry Standard Architecture. Hailing from the early days of the PC, the ISA bus runs from 8MHz to10MHz with a maximum throughput of 8MB a second. Think slower than a Yugo.

L

LVD Low Voltage Differential (LVD) Signaling. A new transceiver technology, used for Ultra2 SCSI and Ultra160 SCSI cabling and termination, that draws dramatically less power, has a bus length of 12 meters, and is backward compatible with older SCSI devices.

M

Megapixel One million pixels. Commonly used to describe the resolution of digital cameras.

MicroTractrix Horn A proprietary tweeter design that minimizes distortion at higher volumes and focuses the speaker's output into a tighter area for efficiency.

MIDI Musical Instrument Digital Interface. The physical and software methods by which musical instruments are connected to each other.

Mip-mapping Technique used to generate scaled texture maps that involves creating sub-images sized for every inverse power of two, i.e. 1/4, 1/16, 1/32, etc. Creating a mip-map takes time; larger textures take longer.

Mouseovers Describes an action that occurs when the mouse cursor "rolls over" an image and triggers a script to display another image.

Multi-Timbral Ability for a musical device to play more than one timbre or sound at a time.

O

OCR Optical Character Recognition. A scanning device's ability to translate human readable characters, such as alphabets, numbers , and musical notation, into computer-readable equivalents.

On-die L2 Ultra fast memory cache that actually resides on the surface of the CPU. It's generally much faster than discrete L2 cache

Open source movement A computer program or application whose original source code is available for free to all. Anyone can modify and change it, as long as they release the modified and updated code to other users.

P

PC100 An Intel memory specification that outlines how 100MHz memory should be made in a Dual Inline Memory Module.

PCB Printed Circuit Board. Any one of the familiar green or brown boards that features chips and other types of electronic circuitry, e.g., Motherboards, videocards, network cards.

PCI Peripheral Component Interface. 32/64-bit expansion slot/bus interface (running at 33MHz, or half the system-bus speed, and occasionally at 66MHz).

PCMCIA Personal Computer Memory Card International Association. Portable device standard most commonly used in notebook PCs. Now more commonly known as PC card.

Planar Loud speaker design that vibrates a thin flat sheet of metal via the audio signal's current, as opposed to traditional cone speakers that create sound by flexing a magnet on a cone within an enclosure.

Pop-up As you move forward in a 3D environment, the z-buffer is constantly monitoring objects as they approach. When an object crosses the clipping plane into the gaming environment, it is quickly rendered and "pops up."

Port To convert software so that it can be run in a different computer environment.

Process technology In the case of Intel's new 0.18-micron technology, refers to the method Intel uses to build the microscopic structures.

Q

Quad-multitexturing Applying four textures or effects to a model's polygons, usually by performing multiple texturing passes (blending).

R

Random access time The time it takes to read data, calculated by recording the time it takes to read a single sector,.

Ray-traced graphics 3D graphics rendered so that light beams follow individually from their source to an object and back to the camera.

Read burst tests Tests that gauge how quickly data can be pulled off a drive's onboard cache, i.e., a drive's maximum throughput.

Register A small storage cell in a microprocessor that temporarily holds numbers used by a running program.

S

Saturation Color intensity. Reducing saturation all the way makes an image black and white.

SCSI Small Computer System Interface. Pronounced "Scuzzy." A standard, high-speed parallel interface that allows up to seven peripheral devices to be linked to a single controller. It is perfectly suited for true multitasking environments such as UNIX and Windows NT.

Sequential read tests Measure how fast a drive's laser can access data when it's arranged sequentially instead of scattered across the disc.

Six layer process A printed circuit board manufacturing process defined by six layers of printed circuit paths. AMD's initial Athlon motherboard spec calls for a six-layer PCB, as does the PC100 memory specification.

SMP Symmetric Multiprocessing. SMP systems have two or more microprocessors and an operating system that tries to distribute workloads evenly among the processors.

SSE Streaming SIMD (Single Instruction Multiple Data) Extensions. A set of 70 instructions from Intel that speed up the Pentium III's floating-point, integer, and memory streaming power. This processing strategy tells a single programming instruction to perform the same operation on two or more pieces of data.

System bus The pipe that sends data back and forth between main memory and the CPU.

T-Z

3D textures Created when a 3D image is mapped across a polygon surface.

THX An audio standard developed by LucasFilms for theatre and home use. It incorporates a series of electronic developments to reproduce sounds accurately and concisely.

Tile-based rendering A bandwidth management technique that breaks a scene's polygons into a display list and renders them in order, rather than attempting to render the scene in its entirety .

Time shift A feature of personal video recorders that enables you to rewind the television program you're currently watching while recording the remainder of the show.

Transactions per second A "transaction" consists of a request (read or write) followed by a reply (write or read) of the same or different size piece of data.

Ultra160 A new UltraSCSI technology that doubles the overall bus speed to 160MB/sec.

Ultra2 The second generation UltraSCSI technology that doubles the total bus throughput of Ultra Wide SCSI from 40MB/sec to 80MB/sec, by increasing the clock to 40MHz.

USB Short for Universal Serial Bus. A new, faster, digital I/O port proposed by Intel for motherboards. Taking up far fewer resources, this port can act as a serial, parallel, mouse, keyboard, joystick, and even speaker interface.

VC/PC133 SDRAM Two memory specs being pushed to help push memory performance past the PC100 spec. PC133 memory clocks SDRAM at 133MHz. A subset of the PC133 spec is NEC's Virtual Channel memory, which uses ultra-fast SRAM to act as a buffer for PC133.

Vertex An end point that defines a corner point in 2D or 3D space.

Vertex blending A technique that smoothes the appearance of two pieces of geometry that share an adjoining vertex. For example, vertex blending can be used to render more realistic-looking joints, such as elbows and knees.

W.A.R.P. Wide-band Audio Realtime Processor. Enables realtime sound effects to be added to a piece of music.

WYSIWYG What You See Is What You Get.

x86 A microprocessor architecture invented by Intel. The 486, Pentium, Pentium Pro, Pentium II, Pentium III, Celeron, Xeon, AMD K6, AMD Athlon, Cyrix M II, and Centaur WinChip are all x86 CPUs.

z-buffer In 3D games, the z-buffer stores the z-axis value (front to back) of a pixel on-screen. This value is compared with incoming z-value data to determine whether the pixel will be drawn or not, and how overlapping pixels will be presented. A z-buffer's accuracy is dependent on how the 3D accelerator handles z-buffer calculations. It speeds up 3D gaming by not rendering the parts of a scene that are obscured by other objects.

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